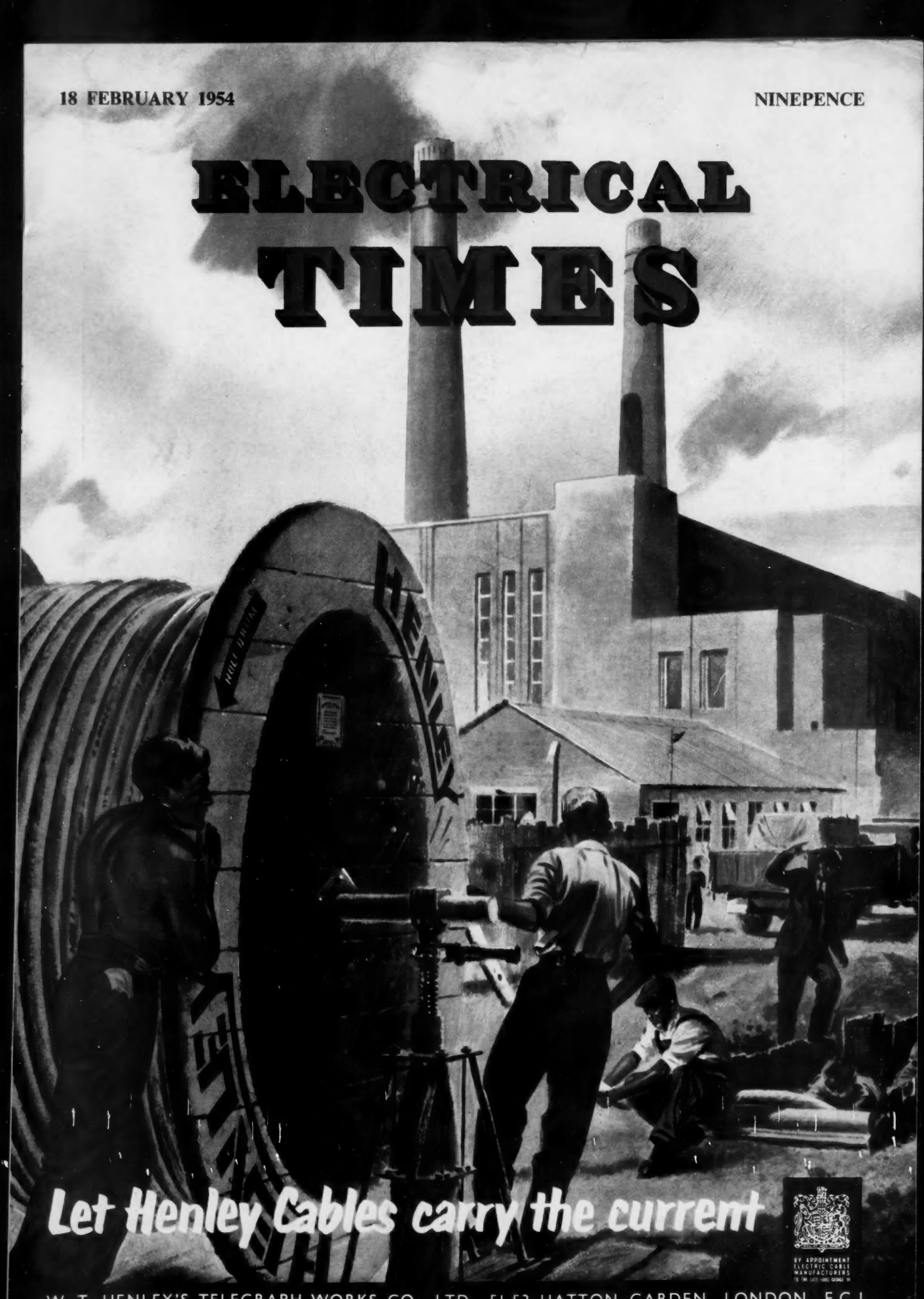
18 FEBRUARY 1954 NINEPENCE

ELECTRICAL TIMES



Let Henley Cables carry the current

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ELECTRIC CABLE
MANUFACTURERS

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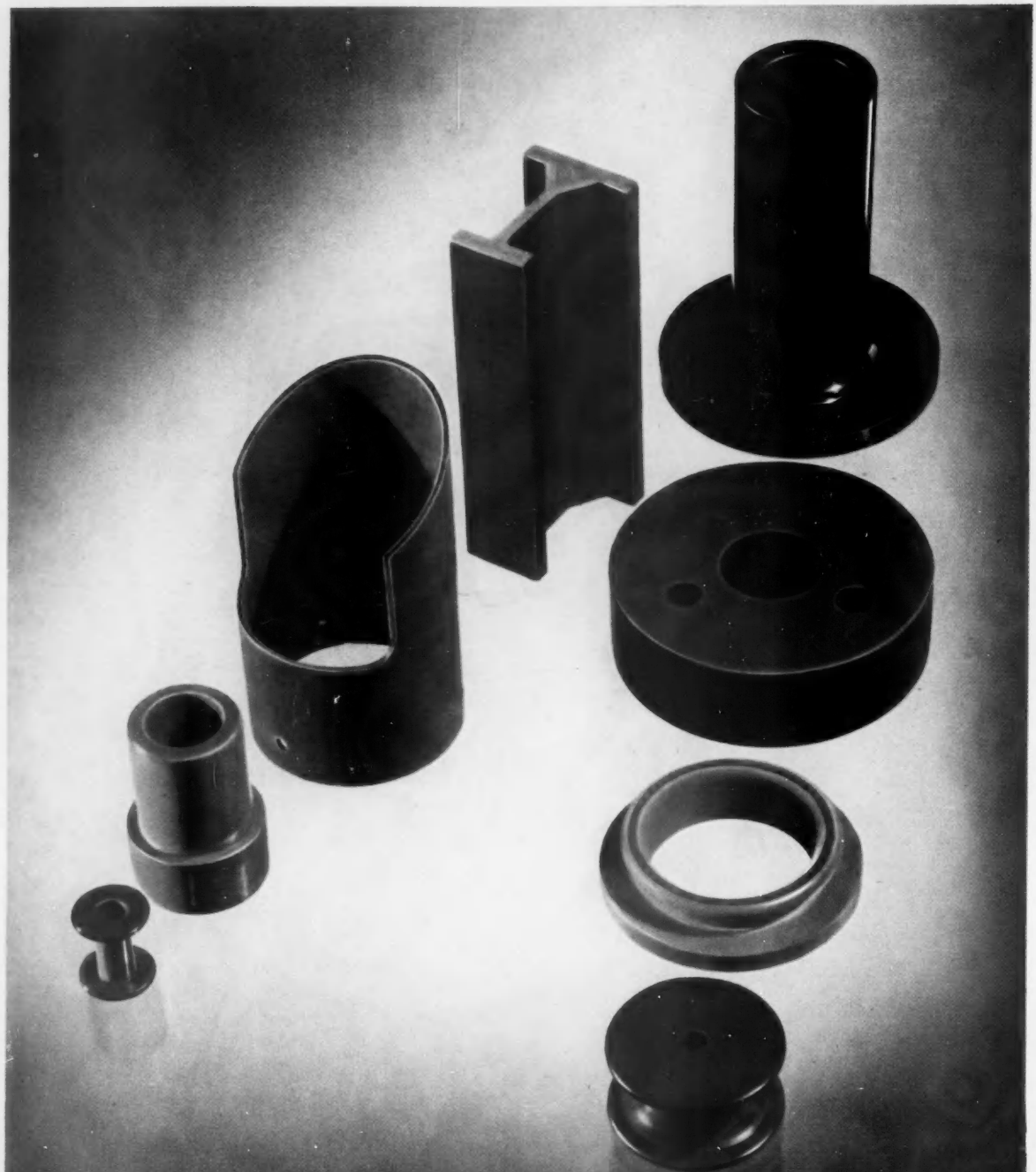

For electrical purposes laminated plastics have to be fabricated into many shapes and forms. Here are some examples of moulding and machining in Paxolin and Panilax.

m and i

THE MICANITE & INSULATORS CO. LTD

EMPIRE WORKS · BLACKHORSE LANE · WALTHAMSTOW · LONDON · E.17

BRANCH OFFICES at BIRMINGHAM · CARDIFF · GLASGOW · MANCHESTER and NEWCASTLE-UPON-TYNE and representatives in most countries throughout the world.

Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. PANILAX Laminated Materials and Mouldings. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS & TERMINALS. Distributors of Micoflex-Duratube Sleevings, Micoflex-Durasleeve (Plastics-covered flexible metal conduit) and Kenutuf Injection Mouldings (in most thermoplastics including P.V.C.)

Standard transformers for rural electrification

AVAILABLE ON SHORT DELIVERY

'ENGLISH ELECTRIC' transformers for pole or platform mounting, and of the substation type to British Electricity Specification T.1, are available for quick delivery.

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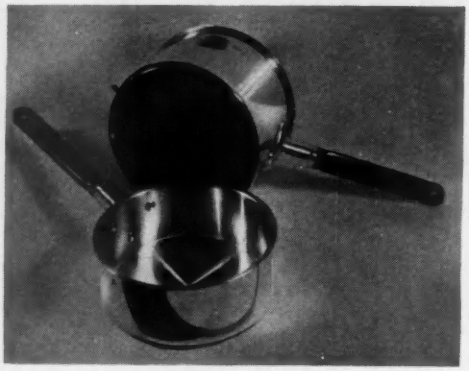
TL9

A

The reasons why *Pyramid* Black Ground Base utensils

Speed your Cooking...



It is well known that black surfaces absorb radiant heat faster than light or bright finishes which tend to reflect heat. The demand for quicker boiling times and consequently lower Electricity Bills has been met. After more than a year of experiments PYRAMID present the new BLACK GROUND BASE range of quality utensils for use on cookers which have both Radiant and Solid hot p'ates. Rapid boiling, functionally designed, and built to traditional PYRAMID QUALITY Standards, this new heat absorbing BLACK GROUND BASE Range will be indispensable to those women desiring maximum speed and efficiency from their cooker.

Here's proof of *NEW* cooking economy!

Type of pan	Type of hotplate	Time in minutes and seconds			
		2 pts.	3 pts.	4 pts.	5 pts.
Light aluminium	1,600 watt radiant	8·42	11·25	13·05	15·30
Light aluminium	1,800 watt solid	10·02	11·55	14·25	17·50
Ground/black-base aluminium	1,600 watt radiant	7·28	10·03	11·45	14·16
Ground/black-base aluminium	1,800 watt solid	7·32	9·54	11·25	13·50

Our ability to meet your requirements and to build prestige through every sale is determined largely by our technical improvement policy; that is, the assistance we give you and your customers through our developments in utensil efficiency. Tested and proven, the new PYRAMID Black Ground Base utensils for electric cookers fitted with Radiant and Solid Plates are a very special part of that service, appealing quickly to a growing demand and building your sales through speed, efficiency and a reputation for leadership in the Development of Quality Utensils.

Hague & McKenzie Ltd.
Pyramid Works,
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PYRAMID
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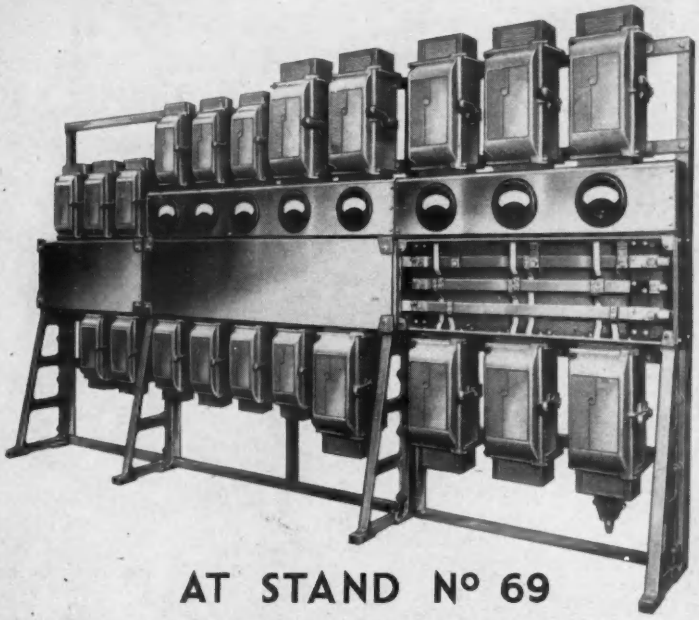
You cannot buy better gear



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(Deluxe Warm White replaces Mellow Colour)

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(New Warm White replaces Warm White colour)

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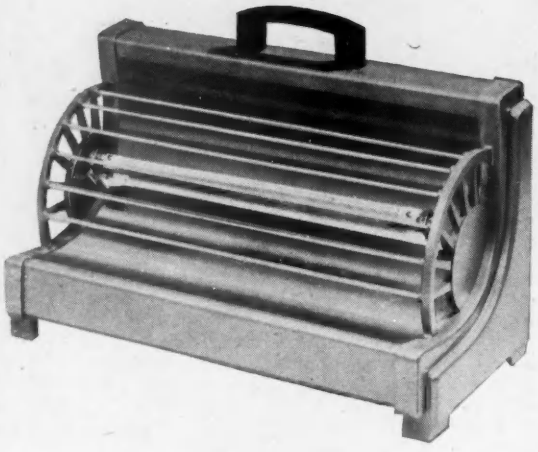

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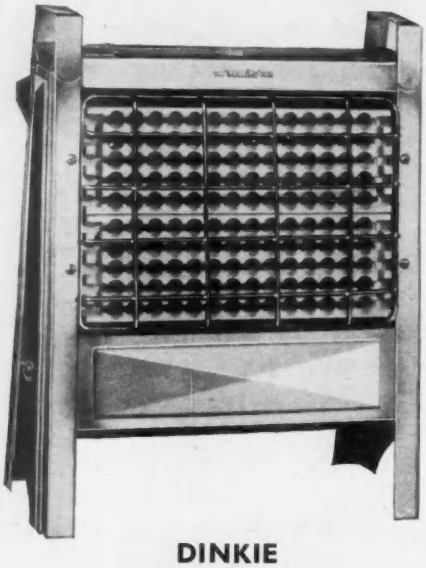

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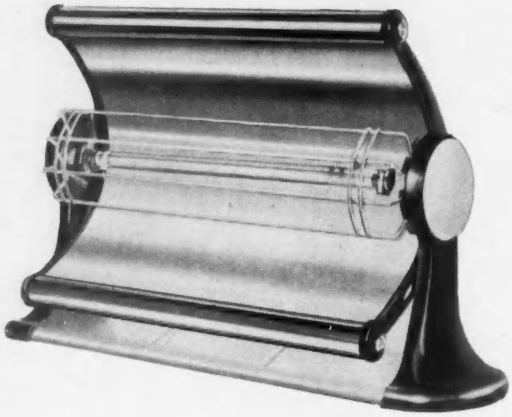

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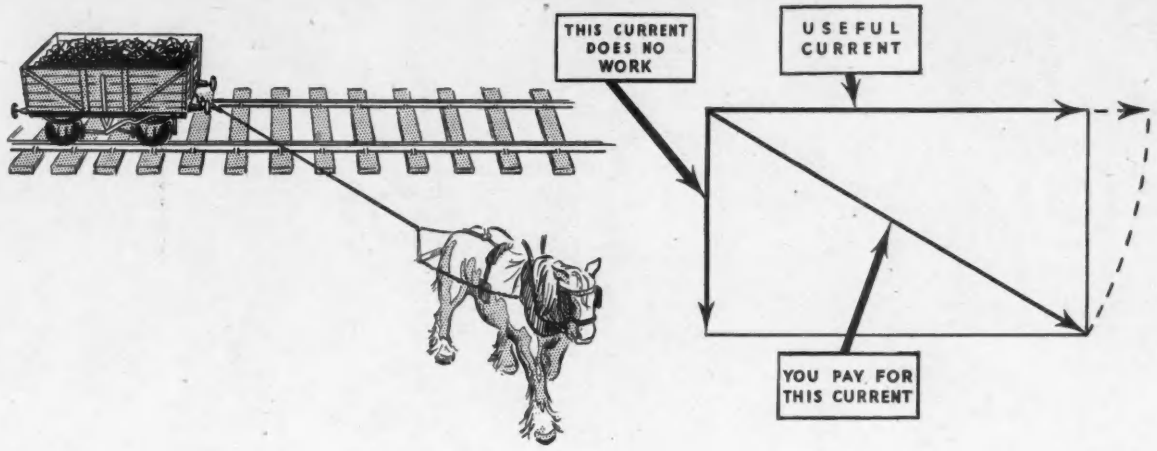

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Much industrial electrical plant still operates at an unduly low "power-factor", and users are penalised for this undesirable condition in their electricity charges.

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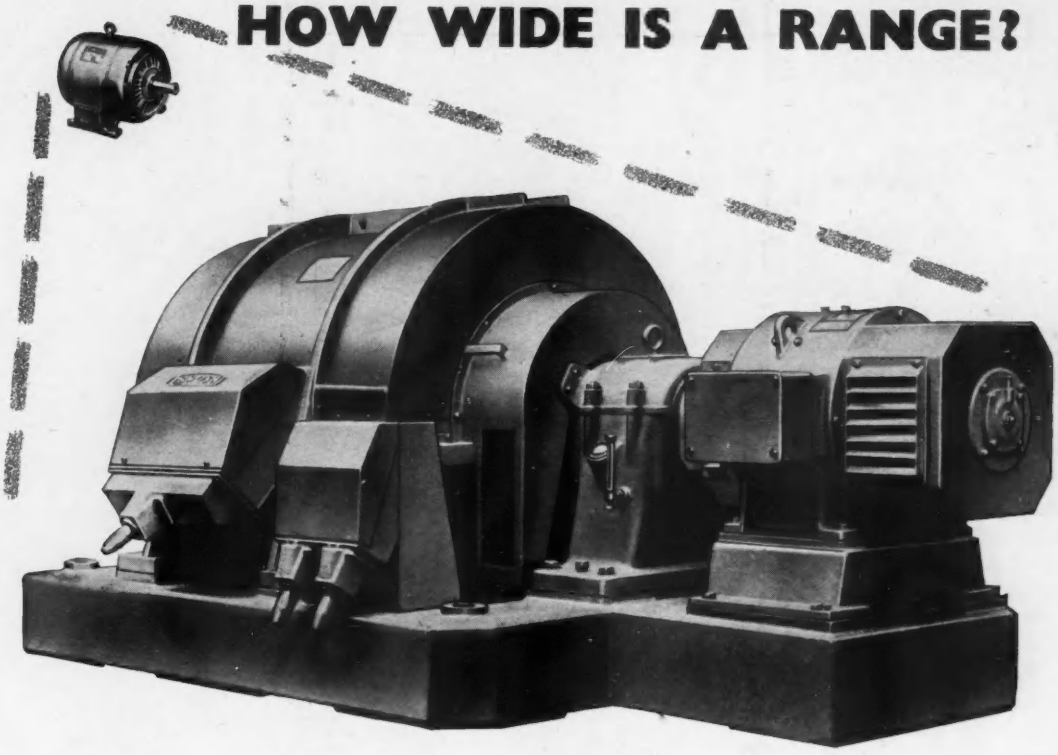

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MK84A
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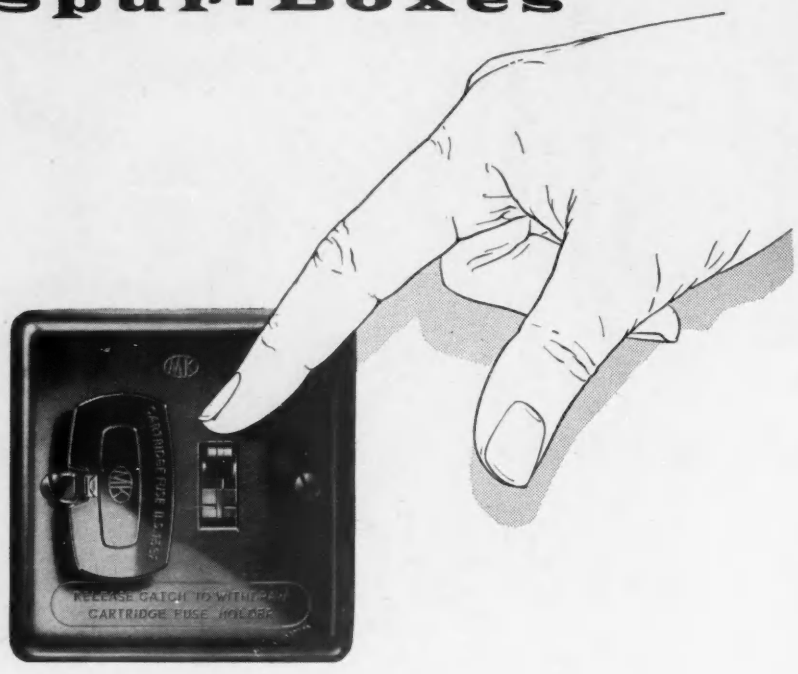
NEW

Fused Spur-Boxes

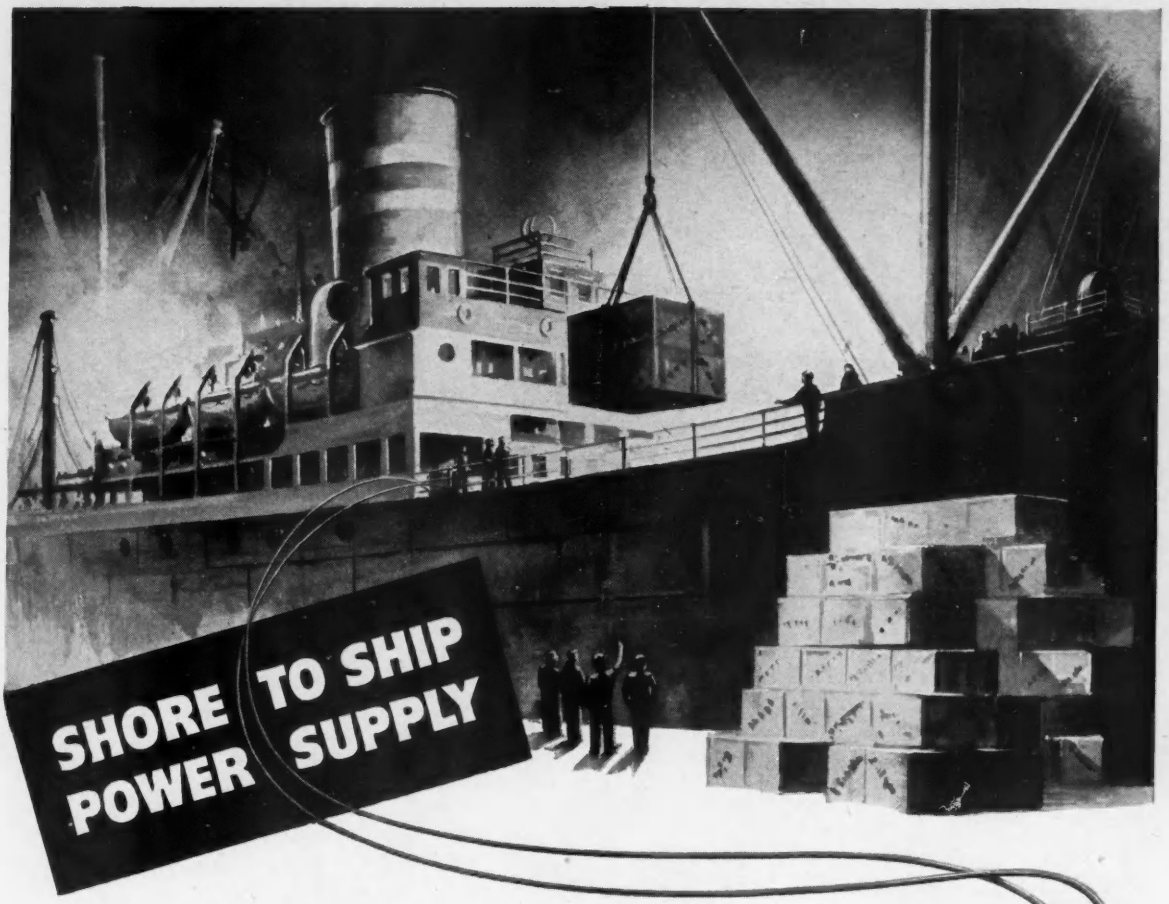


— now switched as well as unswitched

MK fused spur-boxes are already well-known and widely used. Now we introduce new designs incorporating single pole isolating switches. The switched fused spur-box provides by far the most economical and satisfactory means of installing a fixed appliance with additional means of disconnecting it from the live conductor. Leaflet 226 describes the spur-boxes in detail.

MK *. . the mark of safety*

M.K. Electric Limited, Wakefield Street, London N.18 Edmonton 5151



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25 MVA at 400 volts. 50 MVA at 3,300 volts.
With overrating test at 75 MVA.

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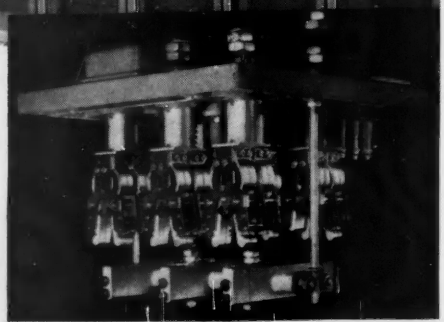
Switchboard illustrated above is installed in a large Lancashire Rayon Mill, and comprises our MB type unit with vertical isolation.

Illustrated on the right is an interior view of the Circuit Breakers in the Switchboard. These Circuit Breakers are tested for the rupturing capacity mentioned above to BSS. 116/1937 and, from the picture, you will see the extreme robustness of the contacts, and simplicity of the design of the patented mechanism.



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Switchgear Specialists

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TRANSFORMERS

provide the most economic method for accurate A.C. voltage and current control, and are particularly indicated for use with television receivers, maintaining the terminal voltage at the required standard.

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INSTALLED IN BRIGHTON 'B' POWER STATION
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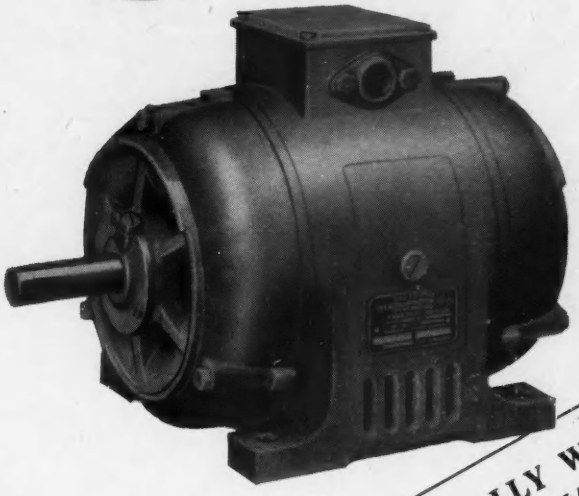
Wheels of industry the world over are turned

by B T-H **ELECTRIC MOTORS**



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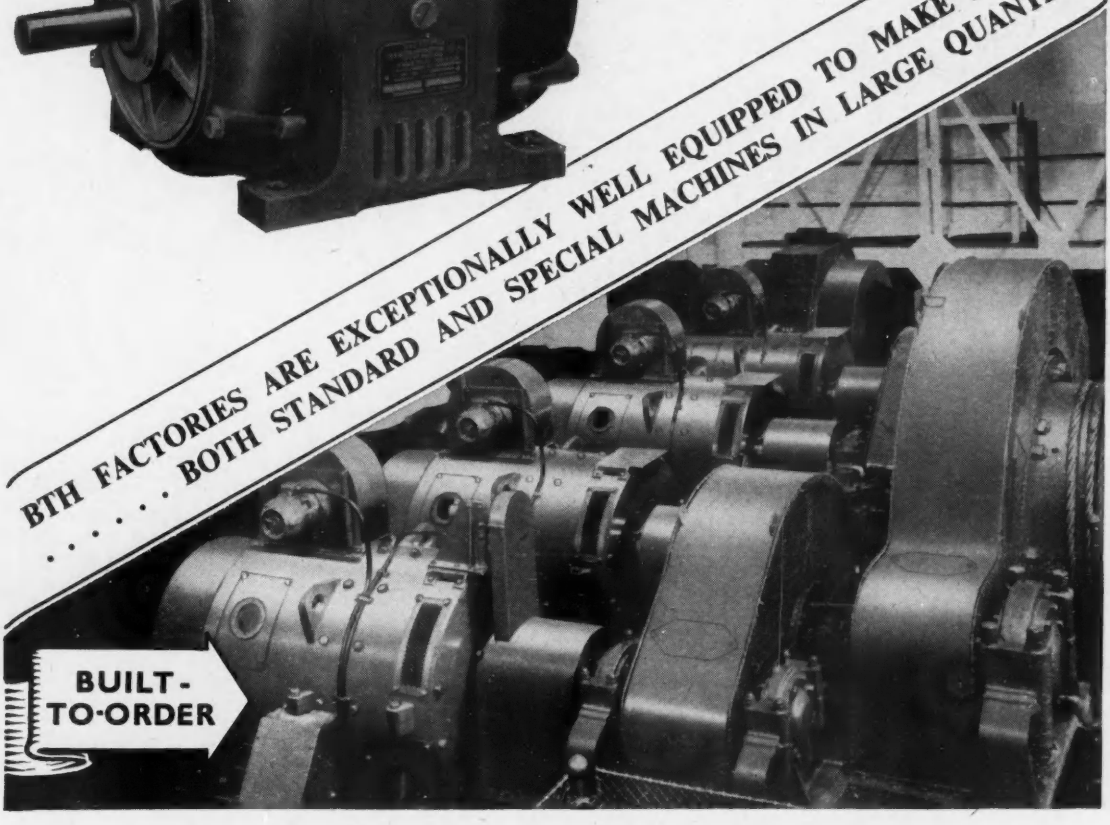

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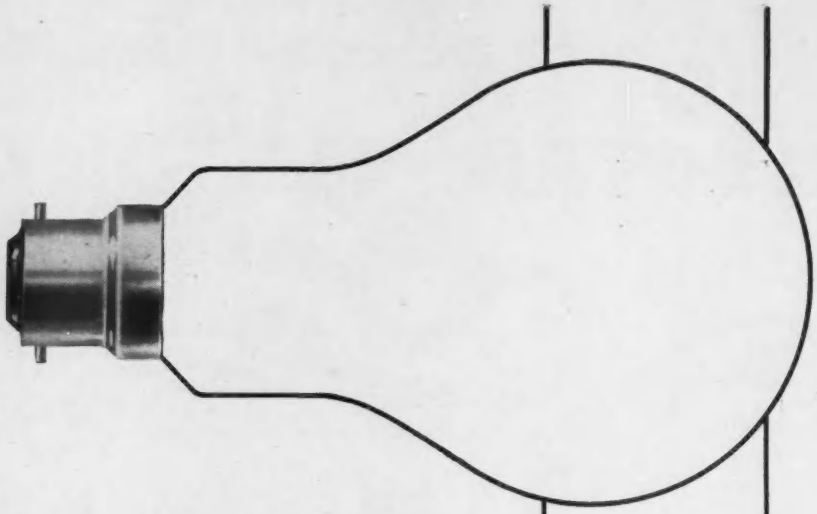

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6/124

It's smooth going for **ballito** nylons

REPUTATIONS MAY HANG literally on a thread in the stocking industry. A barely visible splinter or rough edge on a packing bench can snag a lot of wispy nylons. Ballito keep their good name by taking good care that snags do not happen. They use Delaron Laminated Plastic for smooth non-snag bench surfaces. Other applications of this versatile plastic laminate in the textile industry range from bobbins to bearings.

YOUR JOB FOR DELARON may be very different. Designers and engineers use it for a quite bewildering variety of purposes because it has an exceptional combination of qualities. Some want a cost-cutting material that is virtually unaffected by water, oil, heat, friction and chemicals of all kinds. Some want strength plus lightness. Some want dependable insulation. Some want a material that responds quickly and easily to machining of all kinds. Delaron offers all this at an all-round saving. Look into its potential uses in your product. Find out also how it is being used for machine guards, work trays and a score of other uses in factories and offices.

Write for full information—our technical staff will be glad to help you.

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LAMINATED PLASTIC
MADE BY
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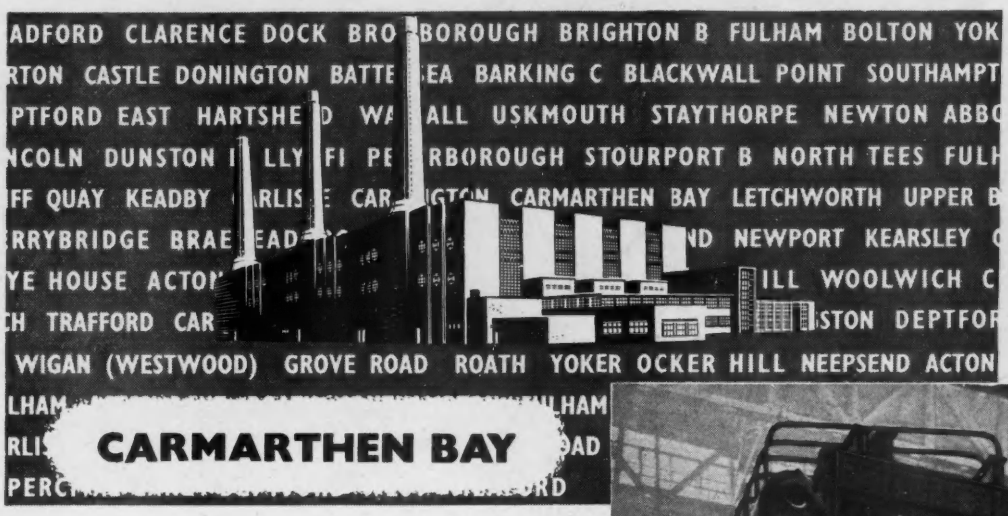
WRITE FOR THE **DELARON** LEAFLET TO **THOMAS DE LA RUE & CO. LTD.** (PLASTICS DIVISION) 84-86 REGENT STREET, LONDON, W.1. REGENT 2901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RRYBRIDGE BRAE EAD ND NEWPORT KEARSLEY
YE HOUSE ACTO ILL WOOLWICH C
H TRAFFORD CAR STON DEPTFOR
WIGAN (WESTWOOD) GROVE ROAD ROATH YOKER OCKER HILL NEEPSEND ACTON
LHAM LHAM
RLI AD
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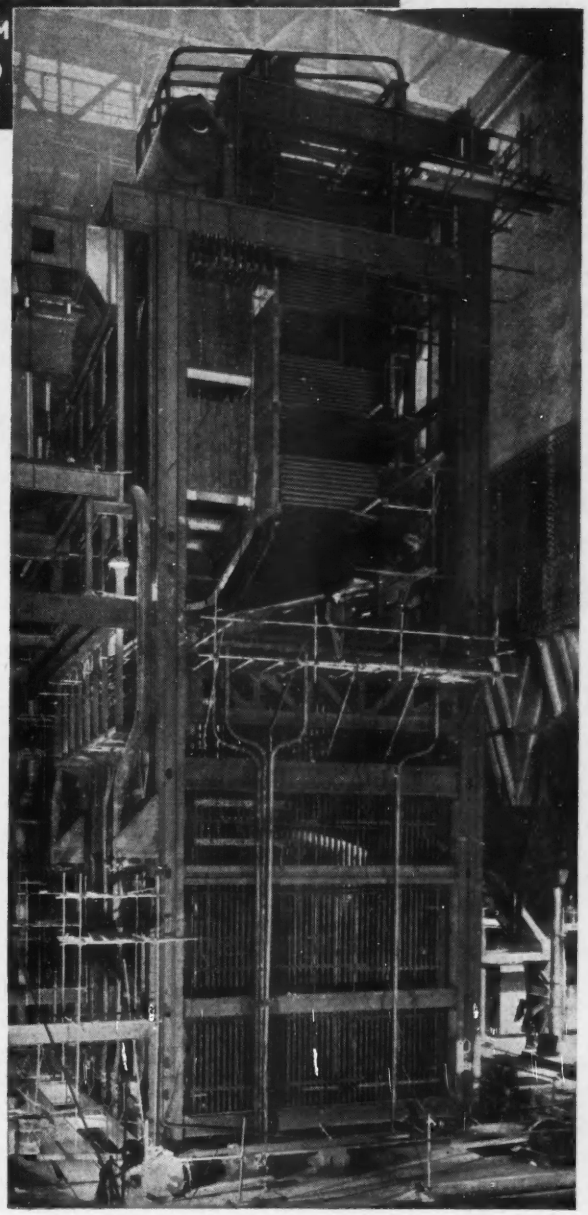
CARMARTHEN BAY



The fifteen Babcock High-Head boilers for the new Carmarthen Bay generating station,* with their evaporations of 240,000 lb./hr. M.C.R. (at 940 lb./sq. in., 925°F), may not be remarkable in size—indeed they may seem small compared with the 830,000 lb./hr. Babcock Radiant-type units now under construction for Castle Donington or those of 550,000 lb./hr. in service at Keadby. They are, however, of a type and size that are giving outstanding service in central stations and large industrial installations all over the world, and they are significant because they were designed for firing with fuel of very low Volatile Content and Ash Fusion Temperature.

They represent the middle of the comprehensive Babcock range of water-tube boiler plant, which includes both header and bent-tube types—W.I.F., Cross-type, C.T.M., High-Head, Integral Furnace, Tri-drum, Bi-drum and Radiant—meeting with proved efficiency and reliability, every steam-raising requirement, with every kind of fuel.

* British Electricity Authority, South Wales Division

BABCOCK BOILERS

The illustration shows one of the boilers during erection. These units are pulverized fuel fired, and equipment supplied by Babcock & Wilcox includes the pulverizing mills and extensive coal handling plant.

BABCOCK & WILCOX LIMITED
BABCOCK HOUSE, FARRINGDON STREET, LONDON E.C.4

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are suitable for the majority of heating problems

Single Circuit Radiant Plates 8" and 6¼" dia.

have you a heating problem? Let us help you solve it!

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FITZWILLIAM ROAD ROTHERHAM YORKS

WHERE?

To the coal mines, the towns or factories? Wherever Hackbridge cables are laid — in Camberley or Cape Town, Brighton or Bankok, they forge a vital link in the chain of efficiency.

Illustration shows a consignment of signalling cables for British Railways.

HACKBRIDGE *Cable Company limited*
KELVIN WORKS, HACKBRIDGE, SURREY
In Association with BRYCE ELECTRIC CONSTRUCTION Co. Ltd.
Branches at BIRMINGHAM, BRISTOL, CARDIFF, MANCHESTER, NEWCASTLE, SHEFFIELD

Storage Problem Solved — at Kearsley

MH 13

...with Beaumont Drag Scrapers

The areas available for coal storage at Kearsley Power Station are of irregular shape, as at so many other stations, but with the Beaumont Drag Scraper system they are used to the fullest advantage. Two Beaumont Drag Scrapers were installed initially for areas A and B, aggregating 82,500 tons of coal. Each plant is under the direct control of only one man.

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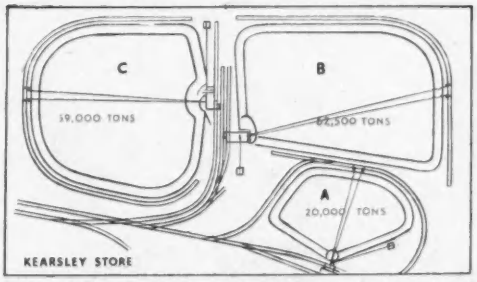

Beaumont Drag Scrapers are suitable for any shape or size of storage area. Maintenance and running costs are low. The simplicity of the system permits unskilled labour to be used.

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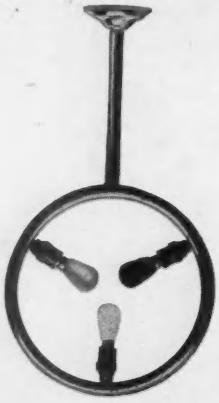

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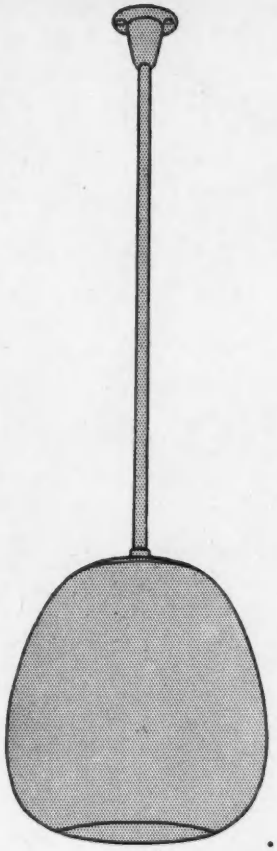

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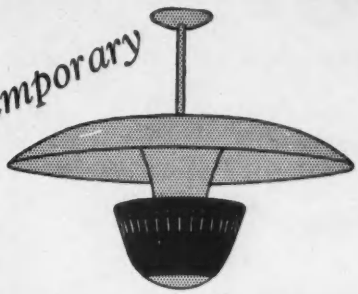

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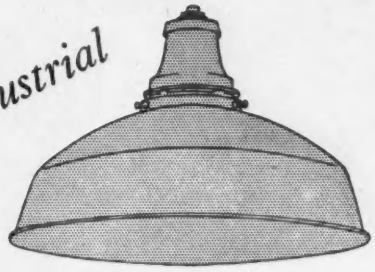
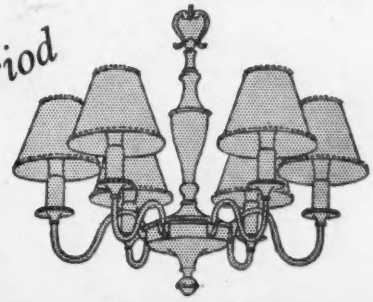


Period



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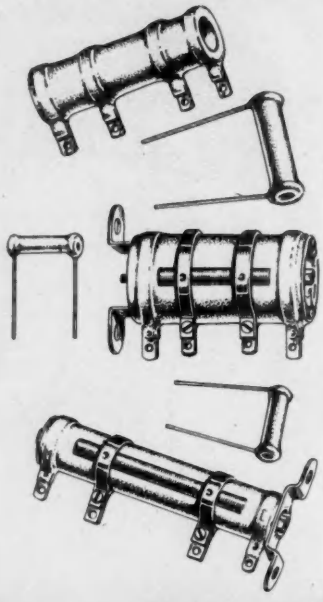

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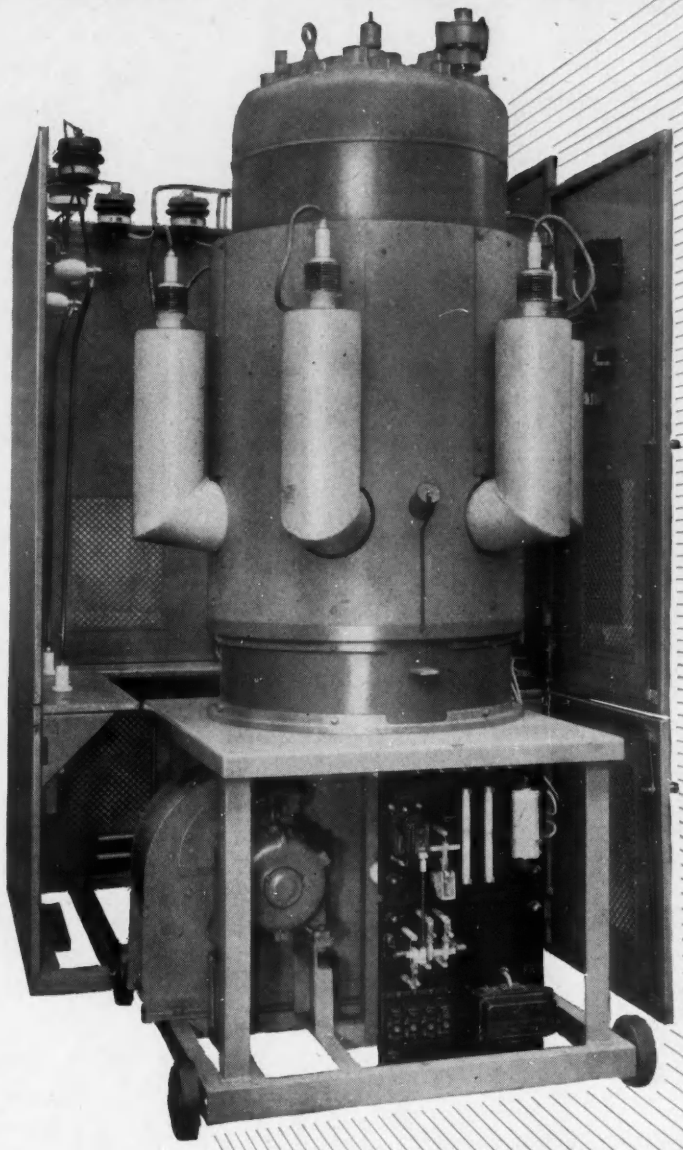

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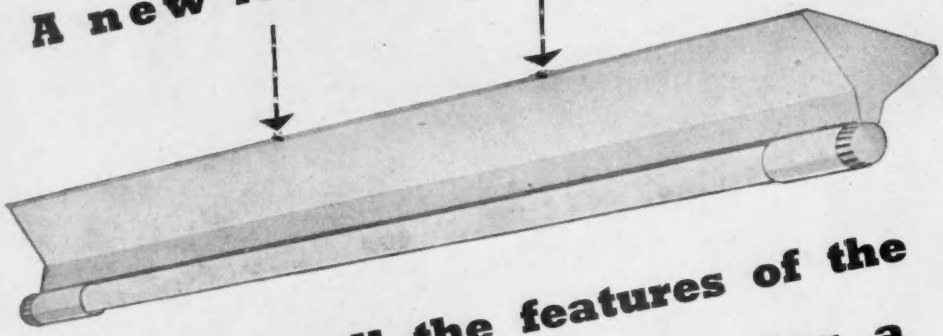
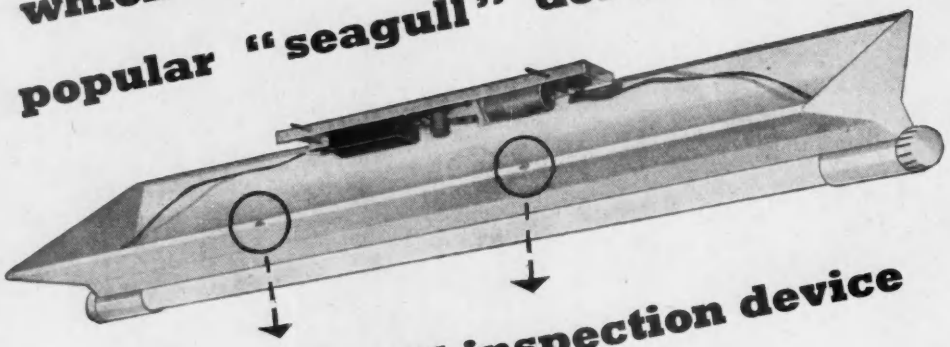
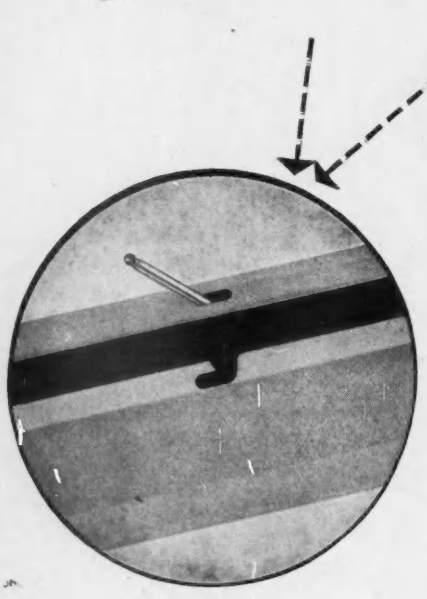
A new ATLAS fitting



which has all the features of the popular "seagull" design plus a



unique "no-tool" inspection device



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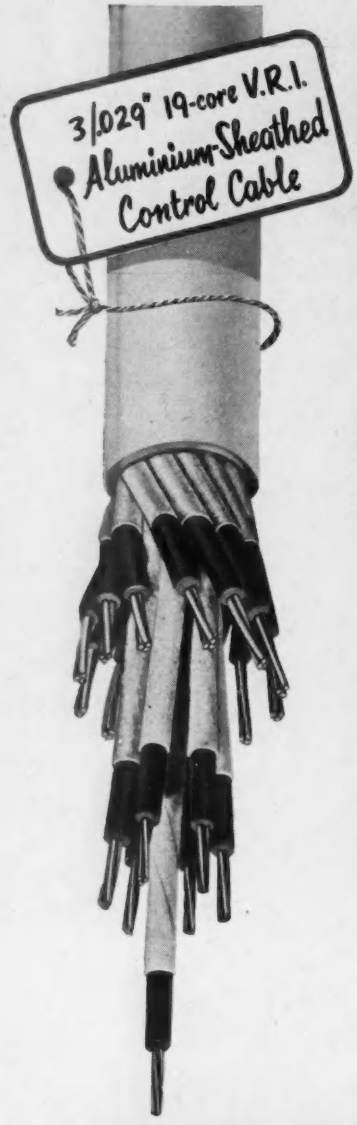

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				MCF/U NEW WARM WHITE	MCF/U DELUXE WARM WHITE
80	B.C.	5	1½	13/-	14/6
40		4	1½	11/9	13/-
40		2	1½	11/-	12/3
30	Bi-pin	3	1	11/-	12/3
20		2	1½	10/6	11/9
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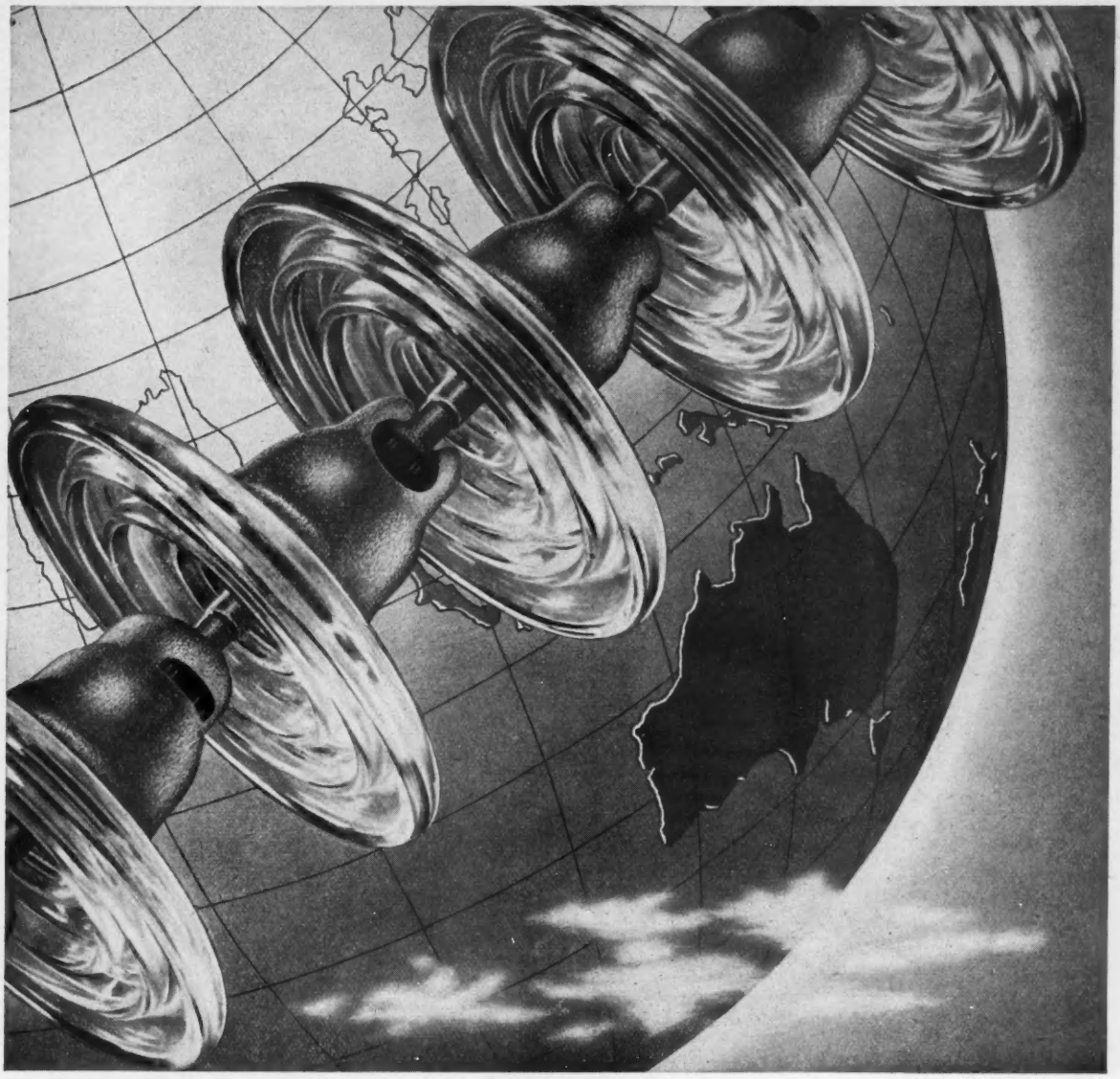

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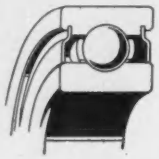
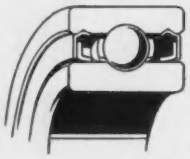


Amongst the variations to this design are the SHIELDED SERIES where metal shields are fitted to either one or both sides.



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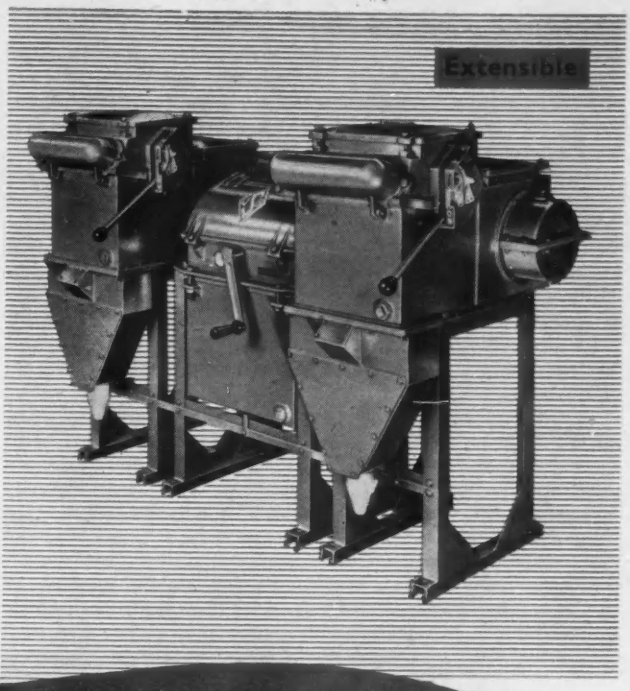

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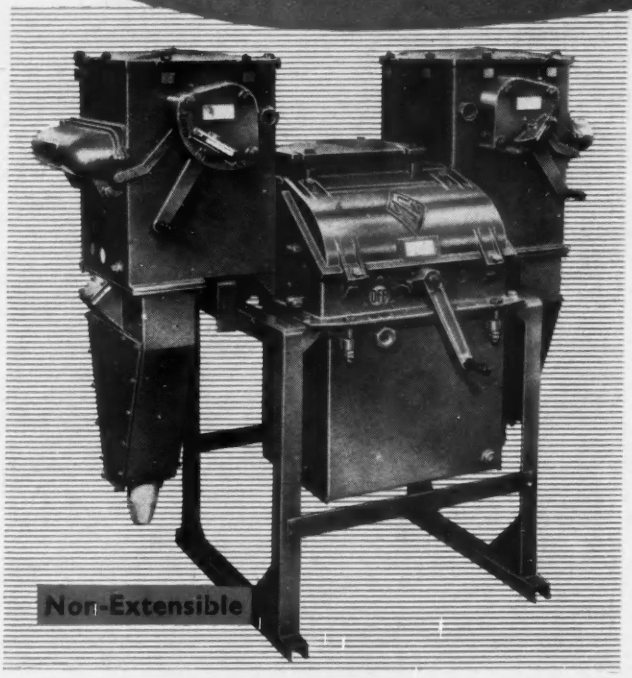

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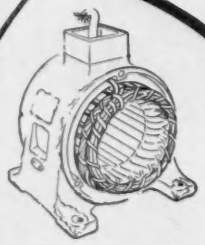

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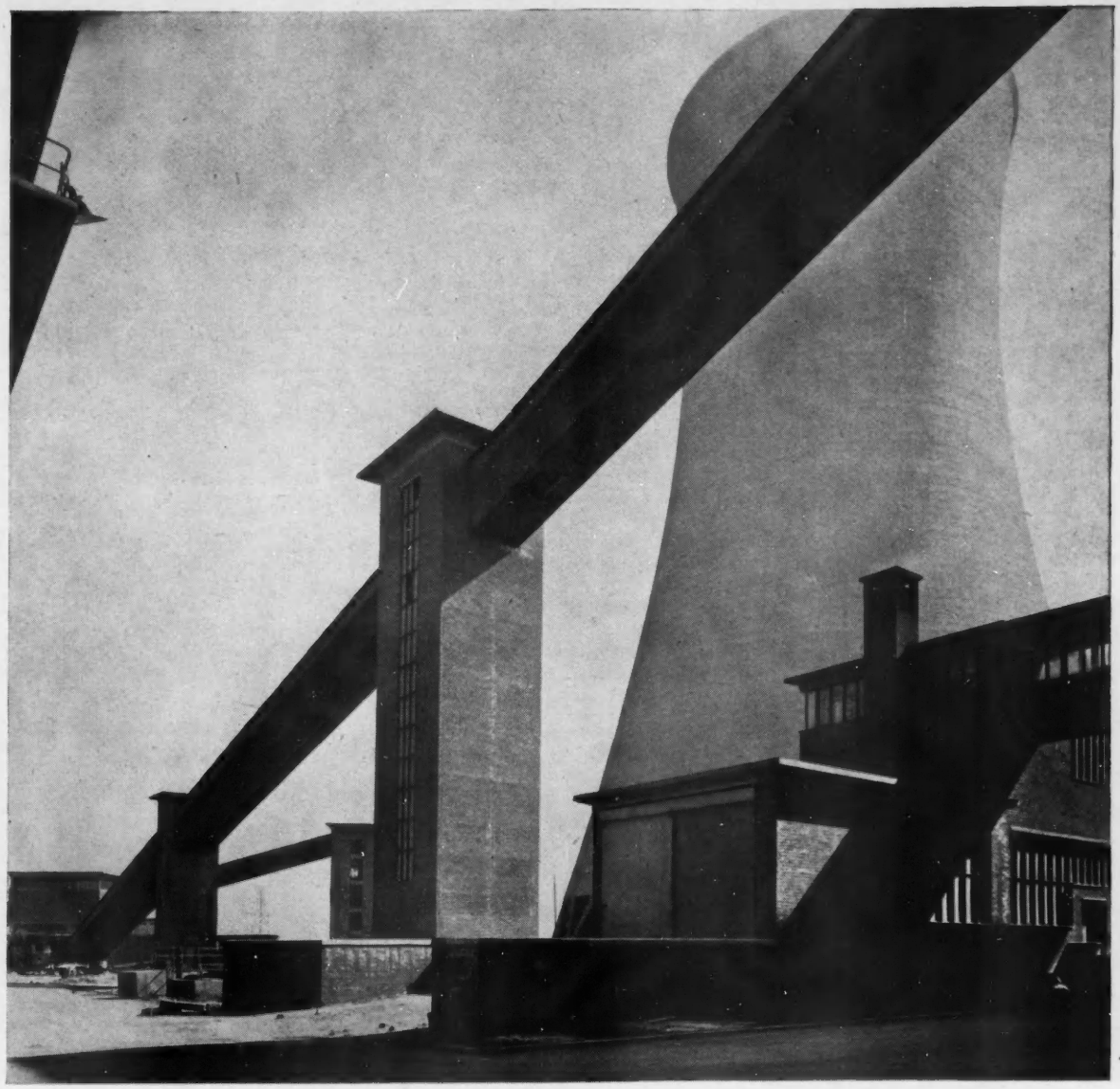

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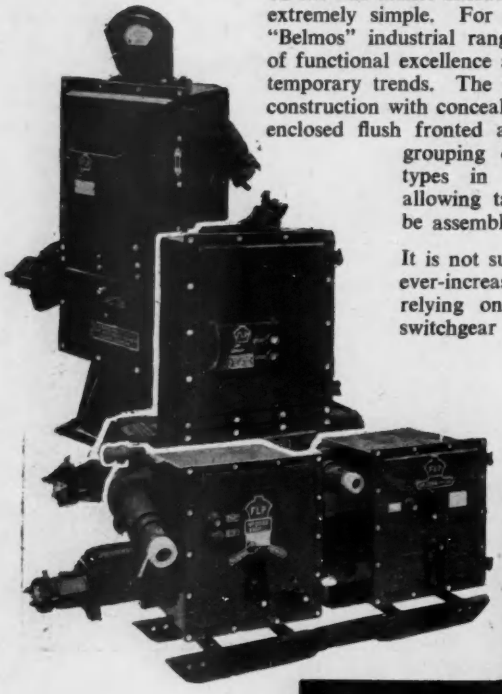

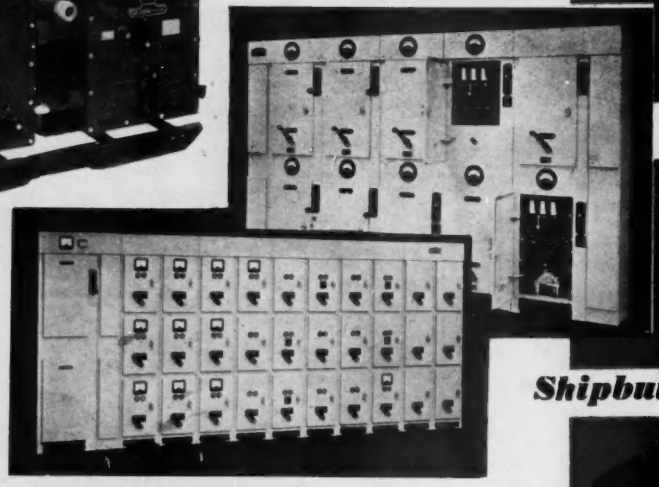

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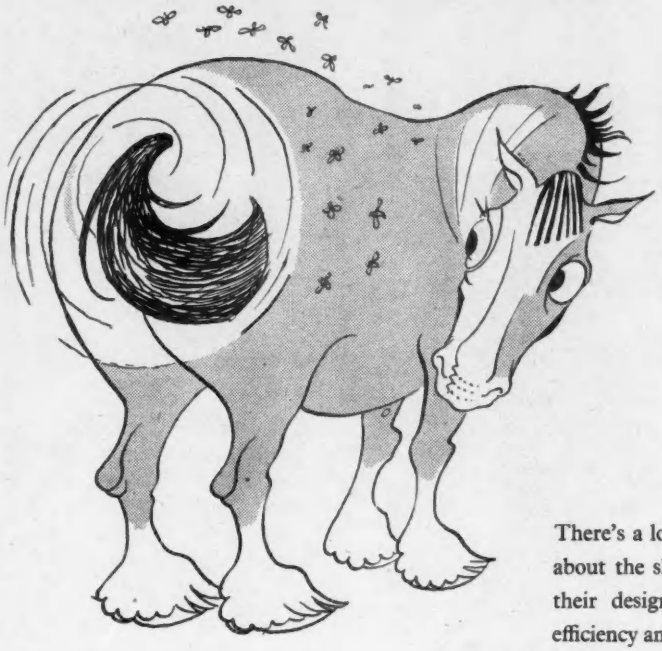


Talking of Switchgear . . .

There's a lot we could say about ours. We could tell you about the skill of our designers and the care with which their designs are manufactured. We could talk about efficiency and long service (though, of course, you can take these qualities for granted when you buy any piece of Siemens equipment). The only thing we could *not* do in a press advertisement is to describe the immense variety of Siemens Switchgear and the purposes it serves. Instead, therefore, we invite you to write for the detailed Switchgear Catalogues, which are yours for the asking.

The Siemens Type 26A House Service Meter illustrated here, incorporates the following advances: slow speed, restricted error Band, low power losses, extended range and temperature compensation.
Approved by the Ministry of Fuel and Power and in compliance with BS 37/1952. *Write for Brochure Z.204/54 giving full Technical Data.*

Make light of it with SIEMENS

SIEMENS ELECTRIC LAMPS AND SUPPLIES LIMITED, 38-39 UPPER THAMES STREET, LONDON, E.C.4

STELLA FLUORESCENT LAMPS

'New Warm White'

The first 5 ft. 80 watt lamp to have an efficiency of **4,160** lumens throughout life (52 lumens/watt at 2000 hours). "New Warm White" is available in all standard sizes down to 18 inch 15 watt.

'Deluxe Warm White'

A new colour which gives greatly improved colour rendering and harmonises excellently with tungsten filament lamps. It is especially valuable in commercial lighting. Available in 5 ft. 80 watt and 4 ft. 40 watt.

Instant-Start Lamps MCFA/U are supplied in both colours

AVAILABLE FROM MARCH 1st

Full details of trade prices etc. from:

STELLA LAMP CO. LTD., 37/39 OXFORD STREET, W.1. TEL: GER 8315

(SL89)

SEE WHAT THIS NEW ASTRAL HOLDS··· FOR YOU

You can share in the ASTRAL lower-the-cost-of-living campaign to win a million customers and profit from the tremendous public demand for this new ASTRAL model.

A FREESTANDING refrigerator, it sets a new standard in style and quality and a new price conception to bring refrigeration home to everyone.

New cabinet; all steel construction; larder-locker for extra storage. 1½ cu. ft. CAPACITY and FULLY ADJUSTABLE SHELVING.

The cooling unit is guaranteed for five years, the cabinet, controls and allied parts for one year.

THE NEW FREESTANDING *Astral* REFRIGERATOR

★ National advertising will support this and the now familiar Table model ASTRAL you sell so well. Make sure you have them both on display.

Product of Astral Equipment Ltd., 96 Buchanan St., Glasgow, C.1.

ANACOS REGD.

RODS, WIRES, STRIP, STRAND, SECTIONS, AND FORGINGS FOR ELECTRICAL PURPOSES TO STANDARD SPECIFICATIONS OR SPECIAL REQUIREMENTS

We welcome your enquiries

FREDERICK SMITH & COMPANY

ANACONDA WORKS, SALFORD 3, LANCS

Incorporated in The London Electric Wire Company and Smiths Limited
Associated with The Liverpool Electric Cable Co. Ltd. and Vactite Wire Co., Ltd.

TELCON

ALUMINIUM

POWER CABLES

Consider these advantages

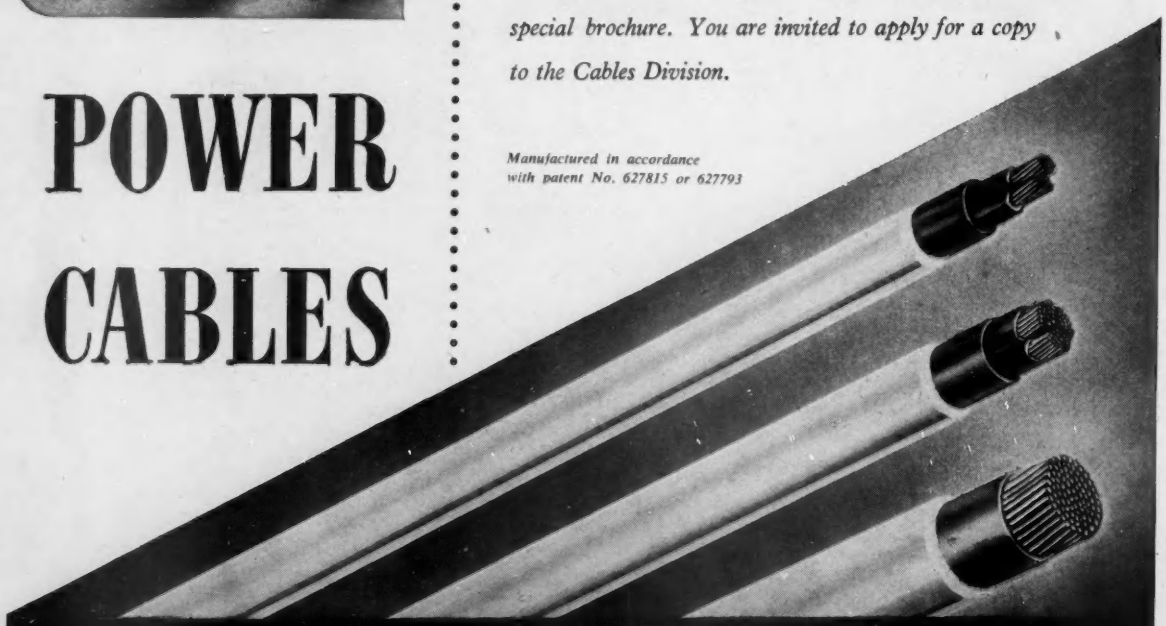
Up to 70% saving in weight over the conventional types, thereby reducing handling and transport difficulties and permitting fewer and lighter fixings for above ground installations.

Seamless aluminium sheath is far superior to any of the lead alloy sheaths in respect of tensile strength and creep resistance.

Improved mechanical properties reduce need for armour.

The construction, performance characteristics and application of Telcon aluminium sheathed cables are fully described in a special brochure. You are invited to apply for a copy to the Cables Division.

Manufactured in accordance with patent No. 627815 or 627793



THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD

Works: TELCON WORKS, GREENWICH, SE10 *Telephone: GREenwich 3291*

Branch Office: 43 FOUNTAIN STREET, MANCHESTER 2 *Telephone: CENtral 0758*

TELCON

Full pages in "Punch" and "T.V. Mirror"

"Punch" February 24
"T.V. Mirror" February 27 & March 13

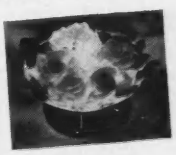
The R.E.A.L. PLINTH LIGHT

No reflection on your screen!

Your reception may be fairly good—good—or very good . . . but your viewing will be made much more pleasant and restful by the gentle diffused light . . . easily placed—say, on the top . . . the eye, and whether . . . provides a subdued . . . most eye-strain.

. . . ation for any room

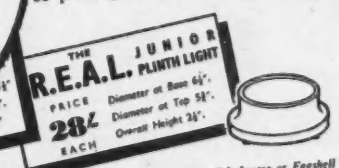
. . . displayed over a R.E.A.L. . . . words can adequately describe . . . halls, corridors and landings, . . . hours of subdued lighting per . . . low glass bowl, carrying the . . . charming table decoration, . . . be prolonged considerably.



Most Good Radio and Electrical Stores WILL be able to supply the demand created by this advertising—

WILL YOU?

Publication No. PLC/14 available on request
PATENT No. 659876

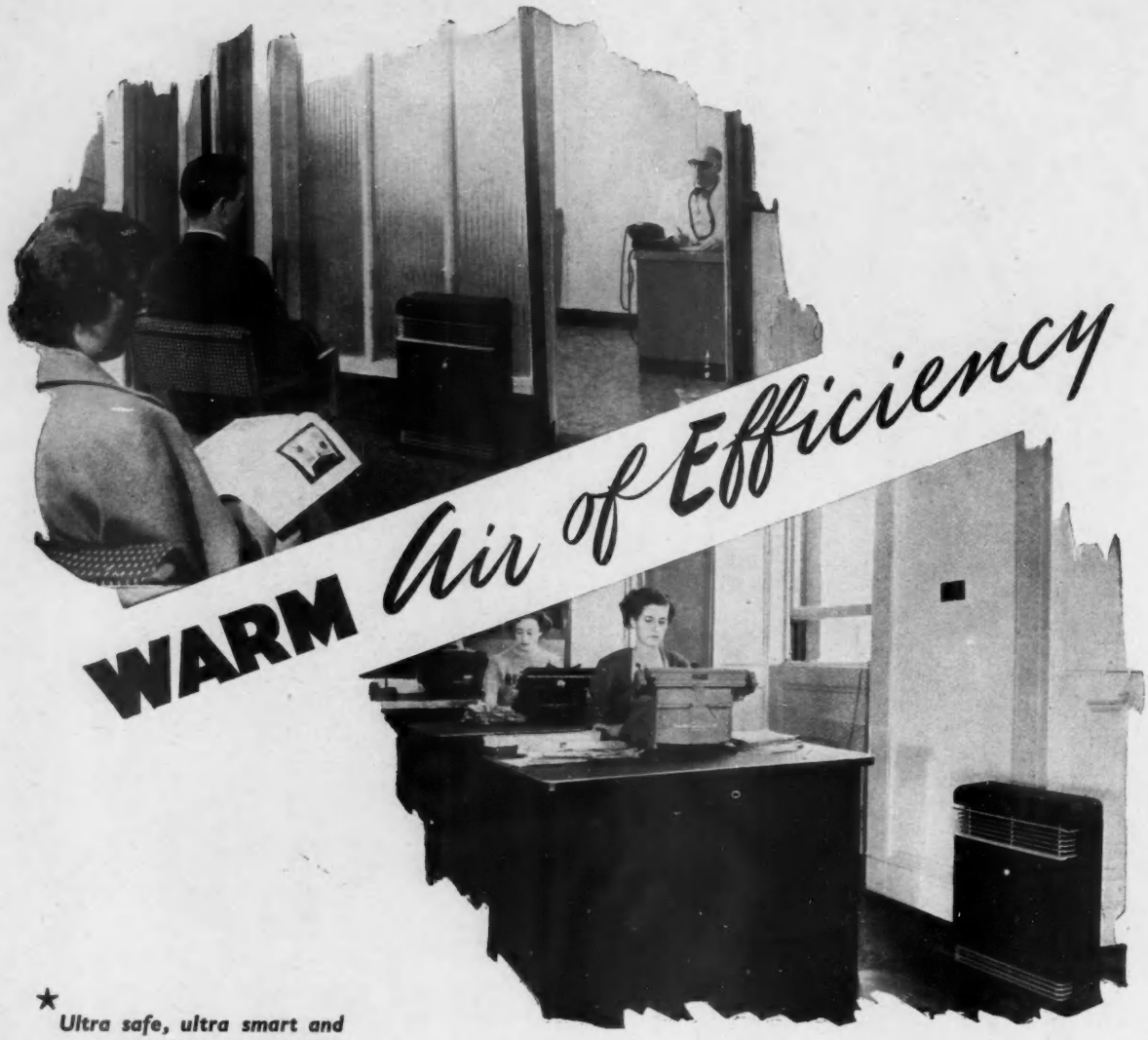


. . . design, and beautifully finished in Pastel Cream, Pastel Blue, Pastel Rose, Gilt Lustre or Eggshell . . . It is provided with shockproof porcelain lampholder, three yards of flexible cord, and heavy glass diffusing plate capable of carrying the heaviest vase or bowl.

Most good Electrical or Radio Stores can supply.

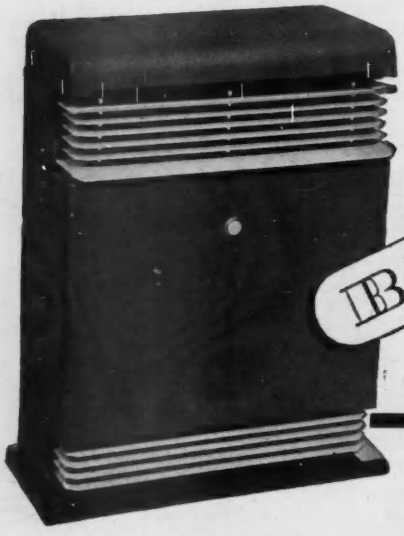
If in difficulty please write to: R.E.A.L. Works (T.V. Dept.), Birmingham, 18.

Issued by Rowlands Electrical Accessories, Ltd., R.E.A.L. Works, Birmingham, 18



WARM Air of Efficiency

★ ***Ultra safe, ultra smart and ultra efficient . . . the B.N.E. Model P.20 Convector.***



The stimulating comfort of the convector-warmed waiting room . . . the efficiency of the office warmed *before* staff arrive by a time-switch controlled Convector . . . the smart appearance of the latest B.N.E. Model P.20—these are the selling points that can bring you profits. Your latent customers may not realise the advantages of the electric convection heater with its automatic thermostat and facility for time-switch control. Tell them! Show them how *they* will benefit. There is a lot of business among shopkeepers and professional and business men if you back your story with the smart B.N.E. Convectors. P.S. If you are interested in a mailing scheme, we would like to co-operate with you. Write to us for details.

B·N·E **Convector Heaters**

BRITISH NATIONAL ELECTRICS LTD.

The Domestic Appliance Section of JOHNSON & PHILLIPS LTD.

NEWARTHILL - MOTHERWELL - SCOTLAND

Steam from COKE BREEZE

COKE BREEZE has always been a *problem* fuel; cheap, and in abundant supply—especially at Steel Works and Gas Works where it is a residual material from their manufacturing processes—but of poor quality and low volatile content.

Now a system has been developed whereby the fuel bed of Coke Breeze is conditioned before reaching the main combustion zone of a furnace so that the maximum heat is extracted. The system is effective even when the Coke Breeze has a high moisture content, and it can be applied to existing steam plants without difficulty.

Known as the "Down Draught System of burning Coke Breeze," this system is described and illustrated in the leaflet (Right). Interested Engineers can obtain a copy or copies of this leaflet from our Main Offices at the address below, or from our local representatives.

Please address enquiries to:

JOHN THOMPSON WATER TUBE BOILERS LIMITED
WOLVERHAMPTON

On March 1st - better light...

Photograph by courtesy of J. Lyons & Co. Ltd.

... for better output

CROMPTON **NEW** WARM WHITE TUBE

Crompton Warm White Fluorescent Tubes have proved their worth in commerce and industry, where a good light is essential and low running costs are important. The NEW Warm White Tubes are even more efficient than before and their price has not been increased. You will get as much as 15% more light throughout their life, and what is more, extra light for every unit of electricity you use.

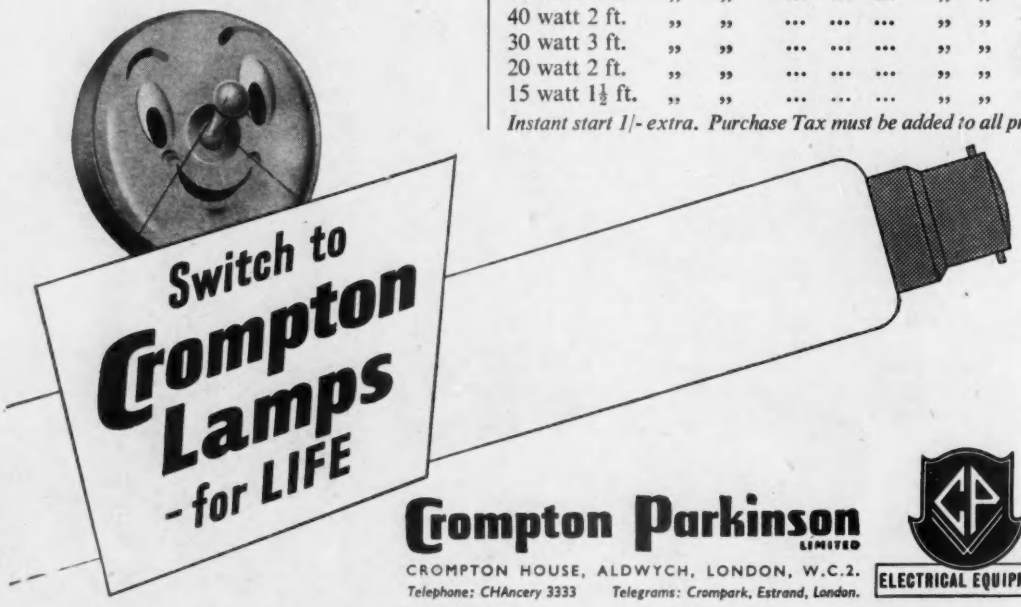
... for better business

CROMPTON WARM WHITE **DE LUXE**

Fluorescent Tubes bring out the best in colours—clothes, food, furnishings and complexions are all flattered by this lovely warm light. The colour characteristics of this tube are very near those of the tungsten lamp, with which it blends most successfully. At the same time, it gives you the well-known economy in running and high light output of fluorescent lighting.

80 watt 5 ft.	normal start	List price **14/6**
40 watt 4 ft.	„ „	„ „ **13/-**
40 watt 2 ft.	„ „	„ „ **12/3**
30 watt 3 ft.	„ „	„ „ **12/3**
20 watt 2 ft.	„ „	„ „ **11/9**
15 watt 1½ ft.	„ „	„ „ **11/-**

Instant start 1/- extra. Purchase Tax must be added to all prices.



BY APPOINTMENT MANUFACTURERS OF ELECTRIC LAMPS TO THE LATE KING GEORGE VI

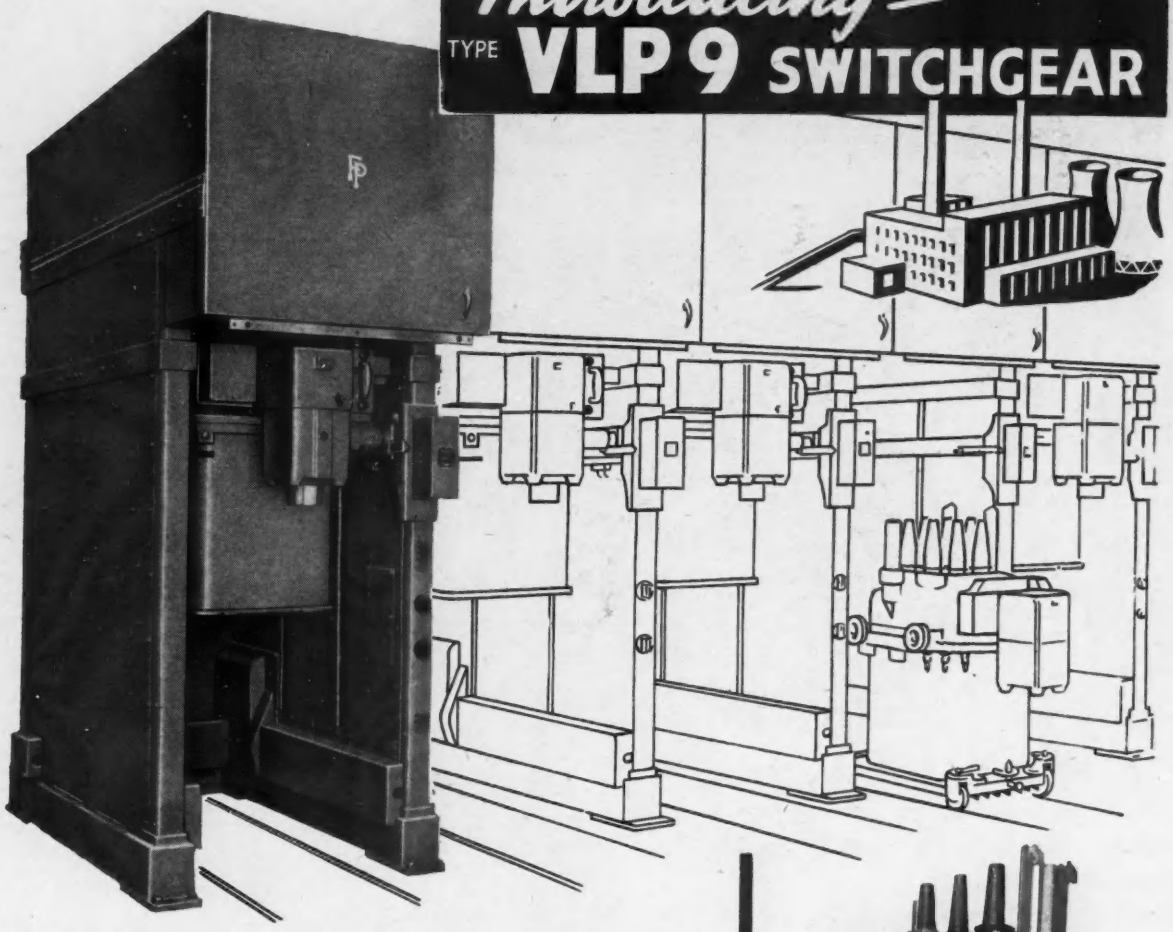
Crompton Parkinson LIMITED

CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2.

Telephone: CHAncery 3333 Telegrams: Crompark, Estrand, London.

ELECTRICAL EQUIPMENT

Introducing—
TYPE VLP 9 SWITCHGEAR



Following the general requirements of first-class workmanship and materials, based upon satisfactory design in all its aspects to ensure reliability in service, probably the most important single feature required of SWITCHGEAR is ACCESSIBILITY to all parts requiring routine inspection and maintenance.

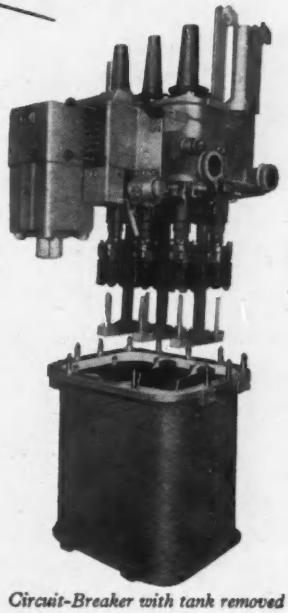
This feature has been particularly borne in mind by " FERGUSON PAILIN " in the design of their new Type " VLP9 " range of Switchgear for 33kV service.

Incorporated are up-to-date features in line with modern requirements in power stations, operational and primary substations.

Those of special appeal are :—

- **Extremely CLEAN appearance of the unit.**
- **Provision of Current Transformers in AIR.**
- **Provision of CONDENSER Type Busbars.**
- **METAL division sheets are provided between OIL CIRCUIT-BREAKER AND CABLES.**
- **Oil Circuit-Breaker is PHASE SEPARATED.**
- **Rapid Fault Clearance.**

Further details of this most interesting development will gladly be sent to Executives or Engineers responsible for Mains Supply.



Circuit-Breaker with tank removed

FERGUSON PAILIN LTD. SWITCHGEAR MANUFACTURERS

Member of the A.E.I. group of companies

Head Office and Works : MANCHESTER 11, ENGLAND *Phone:* Droylsden 1301 (Private Branch Exchange)

LONDON OFFICE: Bush House, Aldwych, London W.C.2. BIRMINGHAM OFFICE: Windsor House, 656 Chester Road, Erdington, Birmingham 23

GLASGOW OFFICE: Central Chambers, 109 Hope Street, Glasgow C.2

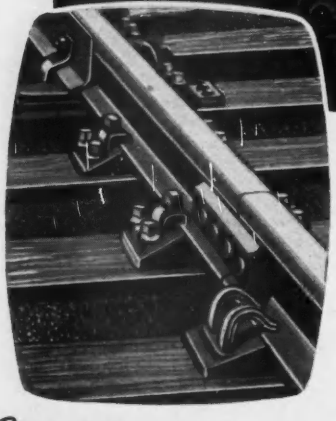
D

SIDINGS by WARDS

A WARD-BUILT RAILWAY SIDING doesn't just happen! Rather is it the result of skilful planning allied to sound railway technique.

Wards have been building sidings for a variety of operating conditions for almost half a century and thus bring to the subject an extensive knowledge of every aspect of railway siding planning, construction and maintenance for industrial usage.

Those who are concerned with the operation and maintenance of private railway sidings will find much useful information in the second edition of our booklet, "Rails and Rail Accessories." Copies forwarded on request.



109 lb. F.B. rails are used throughout this siding. The inset shows the detail of fastenings for this type of rail.

The Railway Siding Consultants and Contractors

THOS. W. WARD LTD

ALBION WORKS · SHEFFIELD

TELEPHONE 26311 (22 LINES) · TELEGRAMS 'FORWARD' SHEFFIELD

LONDON OFFICE: BRETTENHAM HOUSE · LANCASTER PLACE · STRAND · W.C.2

SC/28

IMPORTANT ANNOUNCEMENT

★

New Fluorescent Tubular Lamps (MCF)

New Warm White

For commercial and industrial use, where efficiency is of paramount importance, the New Warm White lamp sets a new standard. The average increased efficiency over the previous lamp of similar colour appearance is of the order of 15%. Performance throughout life, the reliability and progress associated with Royal "Ediswan" Lamps have been fully maintained.

Rating Watts	Dimensions		Average Light Output thro' first 5000 hrs. (lumens)	Average increase of Light Output	Price per Lamp Type (MCF/U)	Purchase Tax
	Diameter	Length				
* 80	1½ ins.	5 ft.	4160	15%	13/-	2/5
* 40	1½ "	4 "	2160		11/9	2/2
* 30	1 "	3 "	1380		11/-	2/-
* 40	1½ "	2 "	1320		11/-	2/-
* 20	1½ "	2 "	800		10/6	1/11
15	1 "	1½ "	480		9/9	1/10

* MCFA/U Instant Start Lamps 1/- extra

Deluxe Warm White

For "social" occasions, where colour rendering is of utmost importance, the Royal "Ediswan" Deluxe Warm White lamp is strongly recommended. The colour of the light is particularly kind to the complexion and blends perfectly with the light from Tungsten Filament lamps.

Rating Watts	Dimensions		Average Light Output thro' first 5000 hrs. (lumens)	Price per Lamp Type (MCF/U)	Purchase Tax
	Diameter	Length			
* 80	1½ ins.	5 ft.	2240	14/6	2/7
* 40	1½ "	4 "	1200	13/-	2/5
* 30	1 "	3 "	840	12/3	2/3
* 40	1½ "	2 "	760	12/3	2/3
* 20	1½ "	2 "	460	11/9	2/2
15	1 "	1½ "	330	11/-	2/-

* MCFA/U Instant Start Lamps 1/- extra.

The above lamps will be available for demonstration as from 1st March, 1954

BY APPOINTMENT
SUPPLIERS OF ELECTRIC LAMPS TO THE LATE KING GEORGE VI
THE EDISON SWAN ELECTRIC CO LTD

ROYAL
"EDISWAN"
LAMPS

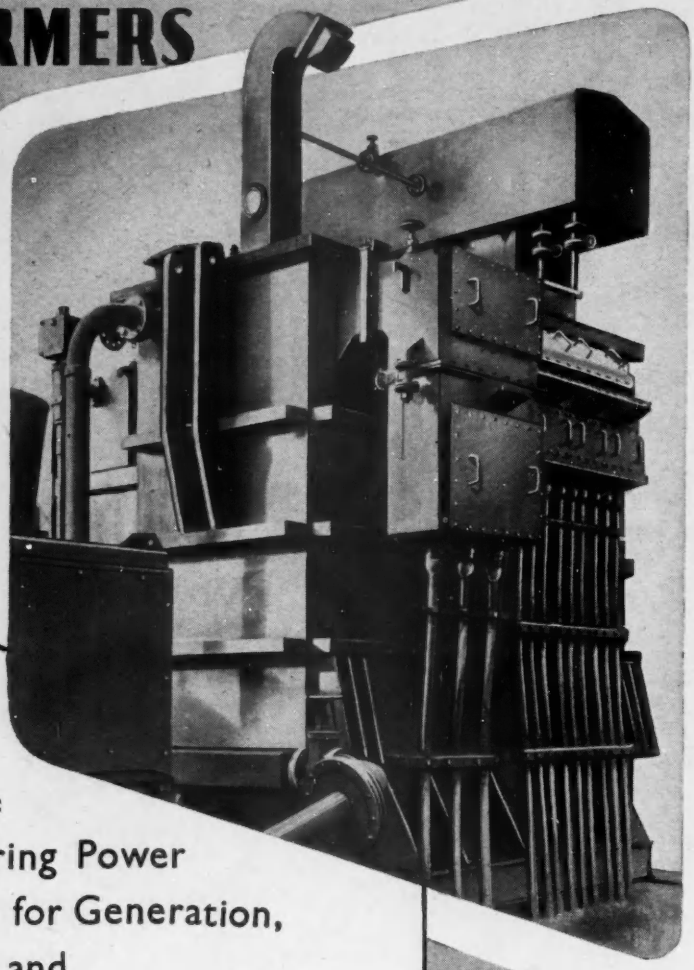
THE EDISON SWAN ELECTRIC CO. LTD., 155 CHARING CROSS ROAD, LONDON, W.C.2
Member of the A.E.I. Group of Companies

L.191

POWER TRANSFORMERS

for

GENERATION
•
TRANSMISSION
•
DISTRIBUTION
•



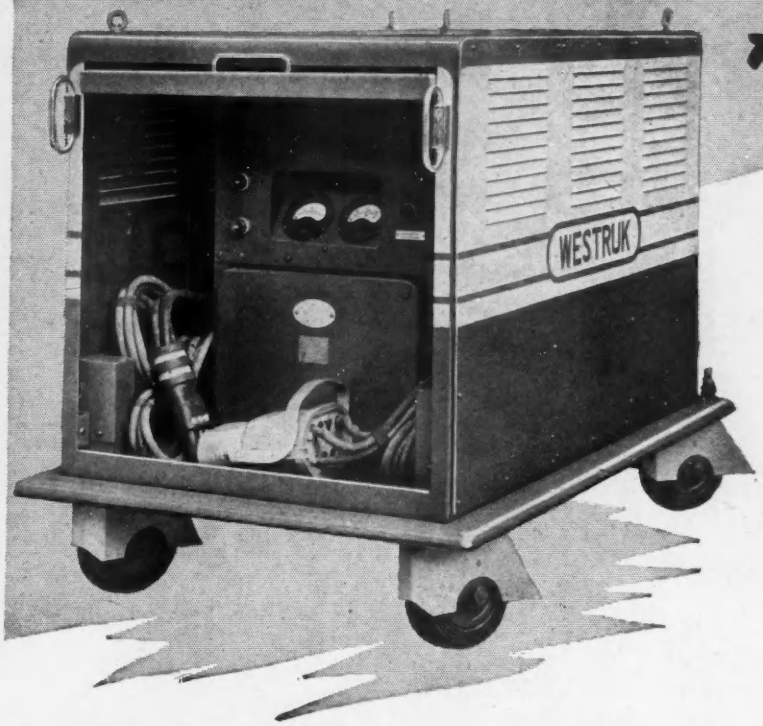
We specialise
in manufacturing Power
Transformers for Generation,
Transmission and
Distribution

All YORKSHIRE Transformers are entirely constructed in our own works. We make Transformers to suit all requirements up to **60,000 kVA—132,000 Volts.**

YORKSHIRE YET TRANSFORMERS

YORKSHIRE ELECTRIC TRANSFORMER CO. LTD., THORNHILL
DEWSBURY, ENGLAND.

STARTING and GROUND POWER for the larger Aircraft



is now available in the *NEW* 'Westruk' Type 960

The 'Westruk' Type 960 has been developed to provide the power required for starting the larger types of piston engined and turbo-jet aircraft, and for supplying the necessary ground power before take-off. It is easily transportable, being mounted on four 8″ × 2″ cushioned rubber tyres and is completely weatherproof. The equipment is designed to give a range of D.C. open circuit voltages from 28 VOLTS to 31·5 VOLTS and has excellent regulation; the rectifier output voltage, when 1,500 amperes is being drawn, falls BY ONLY 5 VOLTS, e.g. O.C.30 volts, and at 1,500 amperes, 25 volts. Starting currents of 2,000 amperes may be taken for 6 seconds. For servicing, the 'Westruk' is continuously rated for 500 amperes.

A double wound three-phase mains transformer complying to B.S.S. 171 and an arrangement of three-phase full-wave Westalite double voltage rectifiers are included in the components of this very important addition to the range of

WESTINGHOUSE

WESTALITE

GROUND POWER UNITS

Details of 'Westruk' ground power units, including the 'Transbooster' range, can be obtained from Dept. E.T.3

WESTINGHOUSE BRAKE & SIGNAL CO., LTD., 82 YORK WAY, KING'S CROSS, LONDON, N.1

BUSBAR CHAMBERS

available from
100 amps. — 2000 amps.
— in —
2, 3 and 4 bar
assemblies
together with complete
range of Circuit Clamps.

FEATURES:

★ Easy extension.
★ Mechanical grip type Circuit Clamps.
★ Busbars can be changed to next larger size with same supports.

QUALITY PRODUCT

KEEN PRICES
QUICK DELIVERY

Write for Leaflet No. BC1

OTHER PRODUCTS: Busbar Trunking: Cable Trunking: Cable-Tap System: Rising Main System: Fuse Units: Fuseboards: Switchfuses: Switchboards & Accessories.

THE POWER CENTRE CO., LTD.

Lloyd Street, Wednesbury, Staffs.

'Phone: Wednesbury 0507 (PBX) 'Grams: "Powcent, Wednesbury"
LONDON OFFICE: Wellington House, 125/130 Strand, W.C.2. 'Phone: Temple Bar 1743

MARTINDALE

MICA UNDERCUTTERS

Whatever your requirements there is a suitable Martindale Undercutter to give satisfactory results.

The **IMPERIAL** Electric **UNDERCUTTER**

is for fast efficient "V" or "U" slotting, and alternative heads and handpieces can be used for driving rotary burrs, files, mounted grinding points, polishing mops, wire brushes, sanding discs, etc.

It is a most efficient electric machine for both portable and shop use for commutators 6" diameter and upwards.

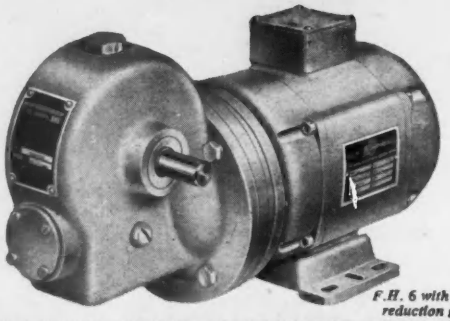
The **PNEUMATIC UNDERCUTTER**

is basically the same construction as the Imperial but is driven by a sturdy high-speed air motor operating at about 100 lb. per sq. inch.

Descriptive leaflets from:

MARTINDALE ELECTRIC CO. LTD.,
45 Westmoreland Rd., London, N.W.9
also at 25 Elmbank Street, Glasgow, C.2

POWER *in miniature*



F.H. 6 with worm reduction gear

"FRACTIONAL HORSE POWER" FOR YOUR JOB

Soundly constructed in top grade materials and of first-class workmanship.

UNIVERSAL MOTORS	1/100 - 1/6 H.P.
THREE PHASE	1/50 - 1/10 H.P.
SINGLE PHASE, SPLIT PHASE and CAPACITOR MOTORS	1/50-1/20 H.P.
D.C. MOTORS	1/50 - ¼ H.P.
GEARED UNITS	0.25-800 R.P.M.

TORQUE UP TO 60 lb./in.
IMMEDIATE DELIVERY!

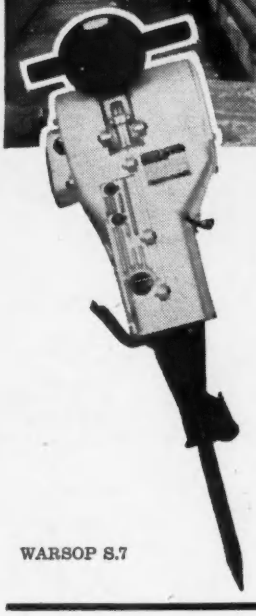
Also manufacturers of domestic and industrial sewing machine motors.
Write now for Leaflet No. E.22. Our Advisory Engineer is at your service.

Hillman ELECTRIC MOTORS LTD.

2-3 NORTHWOLD ROAD, LONDON, N.16. Tel.: AMHerst 5274

Warsops over the white cliffs of Dover!

Top inset.—Photograph by permission of John Robson (Dover) Ltd.



WARSOP S.7

Removing tough concrete war impedimenta from the cliffs of Dover is but one example of the versatility of this Warsop S.7 Breaker.

Working half way up a cliff face presents no problems at all to these rugged, go-anywhere Warsop tools. Their ability to operate efficiently in remote, inaccessible sites has been proved time and time again by most of the large contractors, county councils, and public utilities in the country.

There are Warsop Sales and Service depots throughout the country to help you.

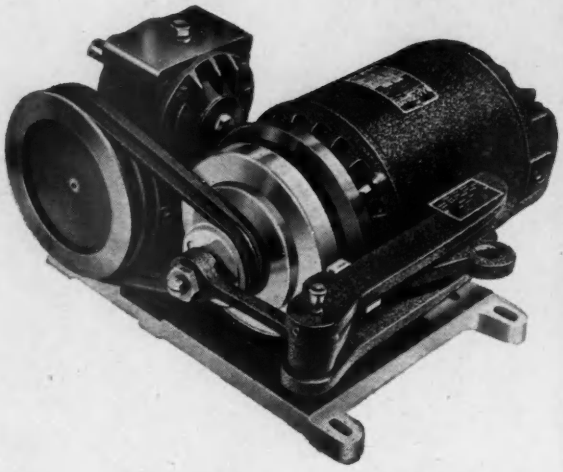
WARSOP
PORTABLE POWER TOOLS

ALSO MANUFACTURERS OF THE NEW WARSOP H.D. ROCK DRILL, WARSOP "BENJO" POWER RAMMER AND RANGE OF WARSOP CENTRIFUGAL PUMPS

WARSOP POWER TOOLS LTD. 27 LOWER REGENT STREET
PICCADILLY CIRCUS, S.W.1. REGENT 4632 (4 lines). *Telegrams: Warpetdril, Piccy, London*

MARDRIVE REG'D

CLUTCH WORM REDUCTION UNIT



The MARDRIVE clutch worm reduction unit is invaluable for low speed drives where it is necessary to start and stop instantly and at more frequent intervals than is possible by direct switching of the motor.

The unit has simple, adjustable, belt tension between the unit and the driven member.

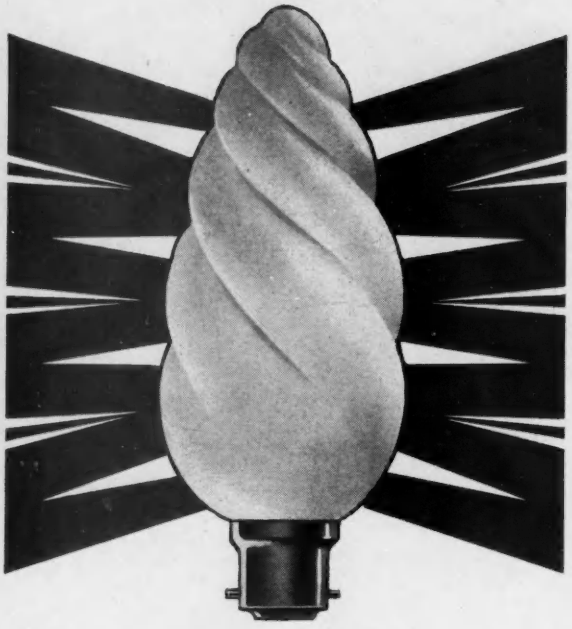
By the use of varying ratios of worm reducers a speed range of from 10 r.p.m. to 115 r.p.m. is readily attainable and with variations of the pulley sizes, this range can be further increased.

These fractional horse-power units are readily available for use on single-phase, three-phase or D.C. electrical supply.

The unique qualities of the MARDRIVE clutch worm reduction unit make for elimination of fatigue and an increase in both quality and quantity of production.

The MARINE ENGINEERING COMPANY (STOCKPORT) Ltd
BULKELEY STREET · EDGELEY · STOCKPORT

LIGHT SIDE UP WITH



LONGER LIFE

Recommend B.E.L.L. Lamps for use in any fitting having an inverted socket. They are made to operate in this position without loss of working life.

Delivery of all types Ex. stock from any of our branches.

B.E.L.L.

DECORATIVE LAMPS

Members of E.L.M.A.

BRITISH ELECTRIC LAMPS LIMITED
229-231 Westminster Bridge Road, London, S.E.1
Tel.: WATerloo 4788/9

Agents' Telephone Numbers:—Newcastle 26804: Manchester—Blackfriars 2459: Leeds 34941: Glasgow—Central 1943: Birmingham—Kings Norton 3452: Cardiff 30561.

It's a point of good design... 14

WHEN CHANGING DUTY—IT'S

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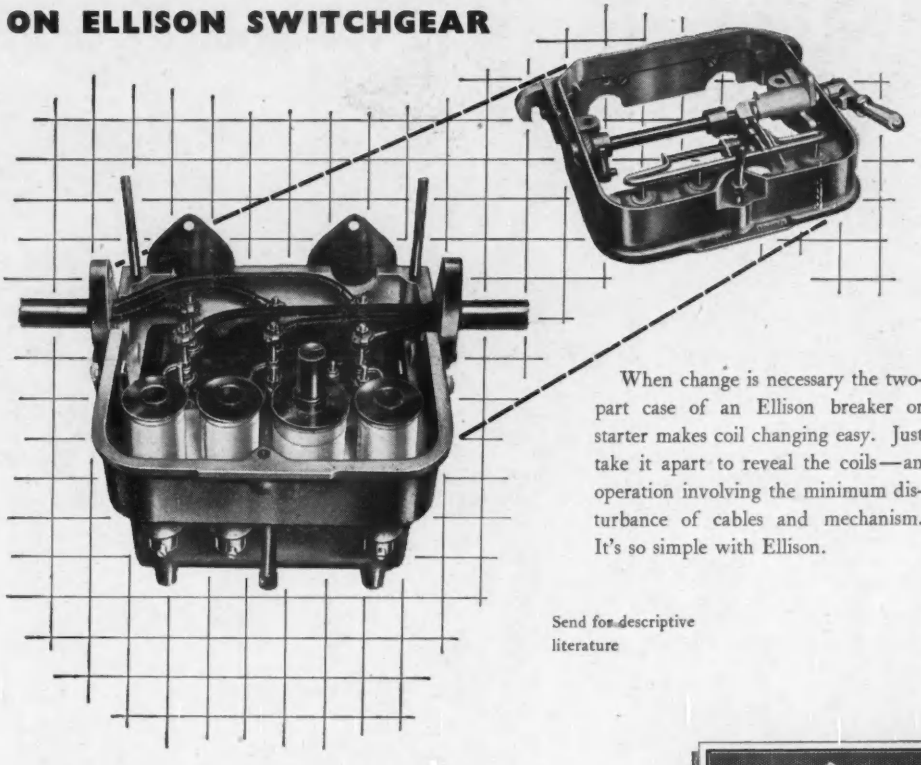

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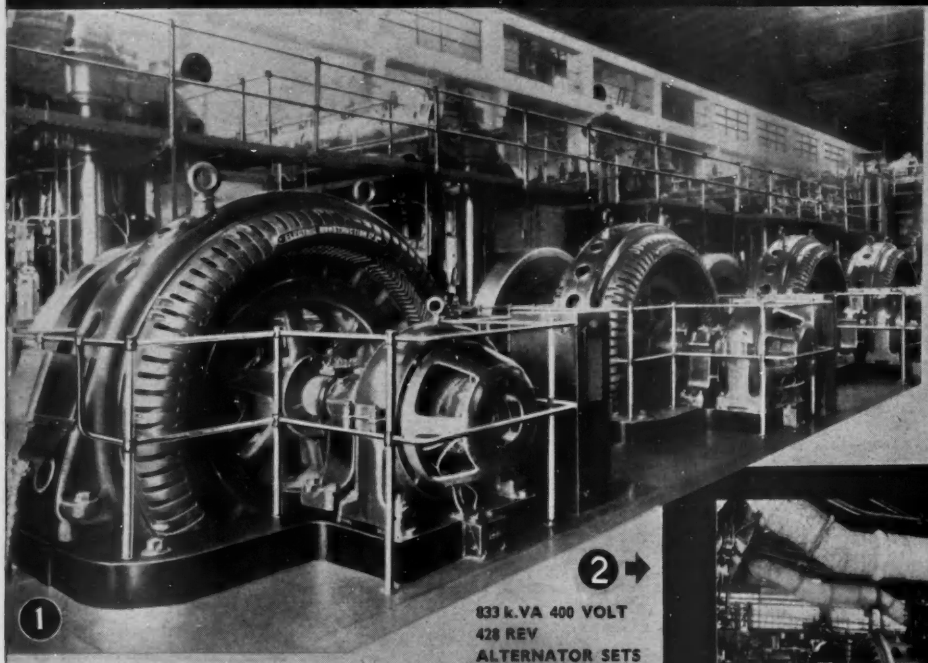

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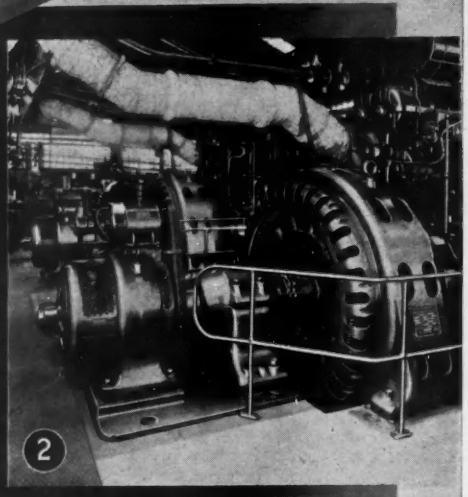

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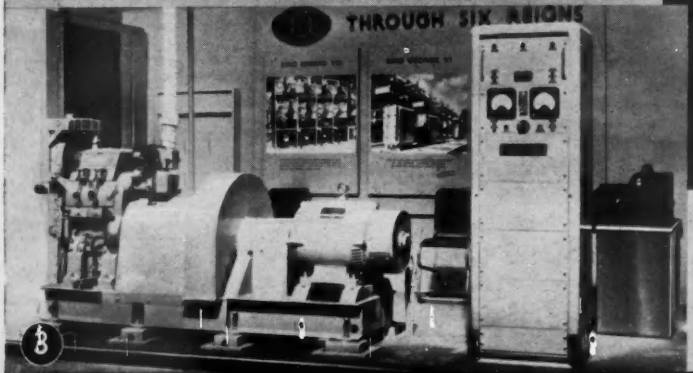

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INOFFENSIVE ENQUIRY

Every nationalised industry, the B.E.A. included, may expect a Parliamentary enquiry into its activities every five years or so. That is the salient fact that emerges from last week's House of Commons debate on how M.P.'s can best be kept informed about the authorities they have created. The one real difference between official spokesmen for the Government and the Opposition turned on whether the investigation should be made rather more frequently by a Select Committee of M.P.'s alone, or only once every seven years. In the latter case there would be a more searching enquiry by a mixed body of outside experts and M.P.'s (a B.B.C. type of enquiry, Mr Herbert Morrison called it). The Government plan will doubtless prevail for the time being, but there is, in fact, relatively little between the two views. Both depart in several important details from the recommendations of the Select Committee which last year considered the whole question and whose report was being debated. Even in the Government plan there is unlikely to be a committee continuously examining the workings of each board, and a high permanent official, with the duty of witch hunting for causes of offence which the Committee can investigate, will not be appointed for the time being. A decision of major importance is that the future plans and policies of the boards will not come within the terms of reference of the proposed committee, which will also explicitly exempt from enquiry relations between a board and the responsible Minister. What is left of the far-reaching plans of the original report is a group of a dozen or so M.P.'s, maintaining through their chairman, liaison with the senior members of the various nationalised industries, and studying the past and present actions of individual boards one by one at relatively infrequent intervals. If the fact is accepted that Parliament is determined to have some channel of information additional to the responsible Minister, then the proposed Committee method has the advantage that it is relatively unlikely to scare anyone into fearful indecision. There are even slight grounds for hope that the result may be increased public understanding of the problems of nationalised industries.

EMPIRE SALES RESISTANCE

That the Commonwealth should buy all its capital goods, and much of its retail requirements, from Great Britain is a comfortable belief that has been disturbed by a number of shocks lately. Hard facts of credit, of delivery and of service are prevailing over patriotic sentiment in the

Dominions and colonies, even when the price and quality offered by British manufacturers are comparable with those of their foreign trade rivals. An example can be found in the advance made by Continental suppliers in West Africa. The ferment of political consciousness which is so apparent in reports from these parts is accompanied by growing industrialisation. British goods may be unsurpassed in quality, but a greater willingness to give attention to the customer's detailed requirements, to help him get equipment operating, and to train his production staff to use it, is helping to secure orders for competitors. Possibly such tactics would not be successful were they unable to offer most attractive credit terms so readily: to counter this factor in the situation top-level Government action would be required. None the less, the other advantages offered are important facets of the mould in which successful salesmanship is being cast today. Hard selling is becoming a necessity not only where dollars are the prize, but also in the formerly safe markets of the sterling area.

REGARDLESS OF QUALITY

Ten per cent on freight rates, with a warning that further advances in costs are likely, is an unwelcome, even though expected, contribution by the Transport Commission towards a future increase in the cost of electricity: especially as this added cost seems likely to be reinforced in the near future by the demand for a higher price for coal at the pithead. Just what the transport increase will cost the B.E.A. is difficult to determine, because of the permutations of distance from coalfields and adjustment of output that apply, but some idea of the order of expense involved is given by the N.C.B. estimate of an increase of between two and four shillings per ton for coal, according to distance carried. At the mean rate this will involve an automatic increase in the cost to area boards of something over 0·02 penny per unit by the terms of the bulk supply tariff applicable from 1st April, assuming that the compensating effects of improved generating efficiency are neglected. Moreover, this and any additional transport charge upratings are, to all intents and purposes, flat rate increases in the price of coal, penalising high ash content particularly heavily. The importance of bringing into operation the Super-grid as a transmission link from generating stations situated near their coal supply is accentuated and, incidentally, the economics of nuclear power generation take a step towards being fully competitive.

NEW LAMPS FOR OLD

Over past centuries, the eye has become accustomed to illumination provided by high temperature sources which normally provide a continuous smooth spectral energy distribution curve. The fluorescent lamp, however, gives a peaky energy curve due partially to the spectral lines of the exciting mercury vapour light and also because of the response characteristics of the fluorescent powders used. Manufacturers have long been aware of this contrast and continuous progress has been made toward obtaining a lamp which would be not only acceptable to the general public in appearance but which would in addition match satisfactorily with tungsten filament lamps. This has now been attained by the introduction of the "Deluxe Warm White" tube. Experiments using this latest advance in fluorescent lamp technique have shown that it is eminently suitable for "scoial" lighting such as is required in hotels, restaurants, shops and other places where people congregate for amusement or business. Tungsten lamps have, because of their comparative small light emitting area, the faculty of producing the high lights and specular reflections which make for life and brilliance, and this in turn reflects on the company so illuminated.

PEAT IN SCOTLAND

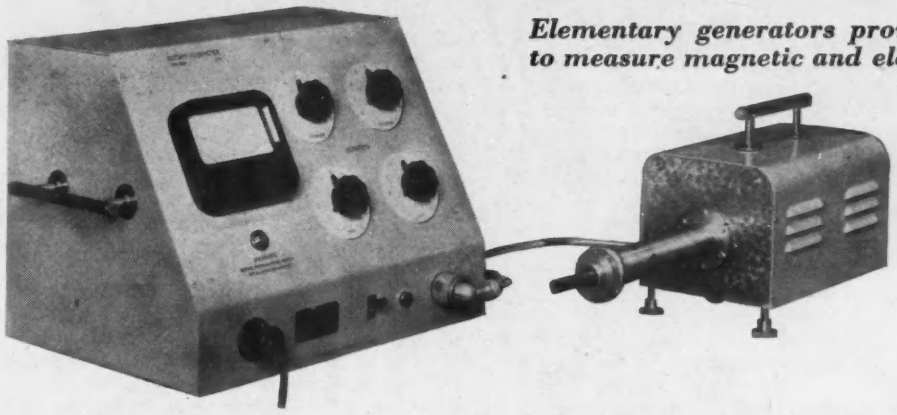
Scotland holds in her highlands reserves of accessible peat estimated at some 600m tons of solids, the equivalent of 500m tons of coal. The late Sir Edward McColl saw the potentialities given to this fuel source by the development of the gas turbine, and his early enthusiasm is now confirmed by the conclusions of the Scottish Peat Committee, which are set out in a report published last week. The Committee considers that both open and closed cycle gas turbines can be of great value in commercial installations, provided some satisfactory means of supplying the peat can be found. The operation of plants on a semi-commercial scale is, indeed, firmly recommended by the Committee, and it seems likely that we shall within a few years see peat fired turbines in operation on a Scottish peat bog. This experiment will be made possible largely by the co-operation of the North of Scotland Hydro-Electric Board, which must be interested in the project not only as an alternative method of generation but also because of their statutory "fairy godmother" duties in relation to the Highlands. Success in the experiment, however, will have an importance considerably wider in scope. Many overseas countries have extensive deposits of peat which have proved difficult to exploit. If British manufacturers can extend in Scotland their mastery of gas turbine technique to include the know-how of peat-fired operation, a valuable additional overseas market should be opened to them.

SMALLER ROTORS?

Increasingly efficient use of materials as a result of improved ventilation techniques has been a feature of large alternator design in the past decade or so. Hydrogen cooling led the way, and this has been proved effective at increasing pressures. Next came news of a design for the liquid cooling of stator conductors, and now the rotor has received attention with direct hydrogen ventilation of the winding copper. According to *Electrical Engineering*, a 125 MW generator recently built in America, is provided with scoop devices flush with the rotor surface, which pick up cool gas from the rotor-stator air-gap and impel the gas axially through passages inside the individual turns of the winding, finally discharging it through holes sloped backwards with reference to the direction of rotation. This coolant flow, which is additional to the conventional feed from each end of the rotor, reduces the temperature of the insulation and makes possible an appreciable reduction in rotor size for a given rating. The basic idea is not new, but its realisation has previously been retarded by fear of air-borne dirt blocking the small ventilating passages, and of abrasion of insulation by the fast-flowing coolant.

Meteor

Elementary generators provide means to measure magnetic and electric fields



GENERATING INSTRUMENTS

By Major E. H. W. BANNER, T.D., M.SC., M.I.E.E., M.I.MECH.E., F.INST.P., M.CONS.E.

BOTH electric and magnetic fields may be measured by means of instruments which include an element which is rotated or otherwise moved in the field. The instrument is thus an elementary generator, the output of which may be indicated, or recorded, on various types of indicating instrument, oscillograph, and so on. Practical use has been made of this principle in a number of instruments, both for electromagnetic fields to indicate magnetic flux, and the current producing it, and also for electrostatic fields to measure very high voltages to earth.

The simplest form, and the one which is easiest to understand, is the d.c. generator case. In a given machine the induced e.m.f. is proportional to field strength, number of turns on the coil or armature, and the speed at which the coil is rotated. When all but two terms are constant there is a direct relation between the two unknowns. Thus if a coil of a given number of turns be rotated at a constant speed the induced e.m.f. is proportional to the magnetic field strength.

Rotary Fluxmeters

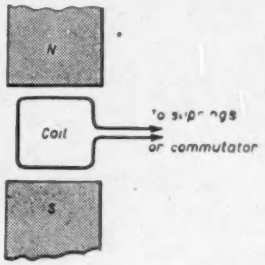
Such an arrangement of a generating instrument forms a rotary fluxmeter, and a practical form is used for measuring the air-gap density in a permanent magnet where the accuracy is required to be higher than can be obtained from a fluxmeter of usual type utilising a single transient induced in a search coil, and measured in line-turns. The rotating coil itself may be quite small, and since it will measure the average flux density through the coil it can be used to explore fields which are non-uniform, to some extent.

The induced e.m.f. is alternating, with a frequency proportional to speed of rotation. For most cases it is convenient to use a moving-coil voltmeter, preceding this by some form of rectifier, which may be a metal rectifier or a synchronous commutator driven by the motor driving the coil itself. When the induced e.m.f. is very small it is convenient to apply the induced a.c. to an amplifier of some form, prior to indication or recording. The elementary form of generating voltmeter or rotary fluxmeter is shown in Fig. 1.

The ordinary fluxmeter itself is a form of generating instrument, but instead of a continuous rotation the search coil is only moved once, generally from the field to a position away from the field, although the converse may be employed, thus giving a transient indication corresponding to the flux density where and when the coil was located prior to its removal from the field, or vice versa.

A different form of electromagnetic rotary instrument has been developed as a form of d.c. transformer to measure current in d.c. circuits where no contact with the source is desired, and which has application to heavy current systems where the indicating or recording instrument is required to be at a distance and shunt volt-drop avoided. The current to be measured magnetises a laminated iron core capable of being opened by a hinge and placed around the cable. In an air gap is a fixed coil and a rotating armature, this armature being an iron cylinder with sector-shaped end pieces, the two ends being at 180° from each other (Fig. 2). The armature is mounted in the gap so that in one position the iron circuit has a minimum reluctance to the main core flux when the path is from one end of the armature to the other; half a revolution later the armature flux direction is reversed. The coil being around the cylindrical core of the armature, the flux alternating in direction induces an alternating e.m.f. which may be taken off to some form of a.c. indicator, being a measure of the magnetising field, and since the main coil has constant turns the output is proportional to current in the main circuit. It is usually more convenient to use a d.c. indicating instrument, and a rectifier network with a smoothing system is then used.

The generating armature is rotated by some form of constant-speed motor. This may be by clockwork or similar means, but in the design evolved by British Iron and Steel Research Association[1] is a specially designed two-pole motor with a shuttle or H armature. The motor has a combined commutator and slip-rings. At starting, d.c. is supplied from the a.c. mains input via a metal rectifier network and smoothing capacitor, and due to the arrange-



Top: Rotary fluxmeter, the rotating element being seen right (by courtesy of William Jessop and Sons Ltd.)

Fig. 1. Elementary form of generating voltmeter or rotary fluxmeter in the magnetic field under measurement

ment of the commutation axis with the magnetic axis, this two-pole motor is usually self-starting. When the speed has run up to exceed 3,000 r.p.m., the d.c. circuit is broken and a.c. supplied through the slip-rings, the machine then running synchronously at that speed on 50 c/s supply.

The d.c. output, although proportional to main current, has no fixed polarity with respect to that of the main current but when this is required to be known the use of a polarising or biasing coil at the generator armature ensures this. As generated the e.m.f. is symmetrical about the zero line, but there is a fixed polarising coil, the current in which is provided by the motor field circuit after rectification. This current may be adjusted, and its field is able to modify the output so that its waveform is completely above or below the zero line, giving a unidirectional but pulsating current. Using a normal side-zero indicating instrument the polarising current is adjusted to bring the pointer up to the centre of the scale for zero current in the cable. In this way the pointer will move to right or left as the cable magnetomotive force aids or opposes that of the polarising coil. Alternatively it may be set to any other position on the scale if required to deal with unsymmetrical waveforms such as in imperfectly rectified supplies and it is desired to show the magnitudes of the forward and reverse currents.

Electrostatic Fields

In an analogous but different arrangement a generating instrument can be made to indicate very high voltage fields where one terminal is earthed, having the advantage of measurement near earth potential and with no connection to the system high-voltage terminal. This has particular application where any form of electromagnetic instrument, including a voltage transformer, would be both expensive, bulky and wasteful of power since a very high series impedance is required to keep the measuring current to a small value, which still represents considerable power due to the product of $I^2 R$. In the elementary form of this type the instrument is basically a continuously variable capacitor, and depending on the arrangement used both high and weak electric field strengths can be measured, the latter using some form of amplifier.

The first form of this instrument appears to be the rotary cylinder type due to Kirkpatrick.[2] There are two fixed rounded electrodes between which rotate two half-cylinders driven by a synchronous motor (Fig. 3). When rotated in an electrostatic field alternating charges are induced on the rotor plates since the whole system is in the field being measured. The induced alternating e.m.f. may be taken off from slip-rings and amplified as a.c. or it may be taken from a two-part commutator and applied to a moving-coil instrument. The output depends on the field strength, the change of capacitance as the motor rotates, and the speed. Since the capacitance in such a simple system is very small, it being physically small, the sensitivity is not high.

To measure very weak fields the capacitance may be increased by employing a multi-part rotor and stator with interleaved vanes, rather similar to that of the common variable air capacitor, and a rotary voltmeter of this type has been described by Greibach[3]. The variable capacitor has a rotor of twenty segments and at a synchronous speed of 3,600 r.p.m. (on 60 c/s), the frequency is thus 600 c/s. A tuned circuit of this frequency is formed by the rotor capacitance and an external inductance, providing an amplification factor equal to the quality or Q of the circuit, which is $\omega L/R$. In an example described in the paper quoted the tuning inductance is 25 H for a rotor maximum capacitance of 2,400 pF resulting in a resonant frequency of 600 c/s which is that of the induced e.m.f.

The amplification, K, due to the higher frequency (where K equals the number of pairs or segments) is 10, and KQ represents the increase in current generated in a given field compared with that of a simple two-part rotor and no resonance. This is 600 times in this example, and so enables very weak fields to be measured.

To measure the very small currents generated by the instrument, the generator must be shunted with a high resistance, necessitating very high insulation resistance for the capacitor rotor. With care an insulation resistance of 10^{12} ohms (one megamegohm) has been achieved, enabling a shunt resistance up to 10^8 ohms to be employed. Using a commutator to rectify the generator output, an indicating instrument with full-scale deflection for 100 millivolts is possible; this voltage and resistance correspond to 10^{-9} amp at f.s.d. Using still more sensitive indicating instruments, full-scale deflections for only a few millivolts are obtained.

Further Development

What may be considered the next development is in the cylinder being replaced by rotating sectors which alternately screen and expose another set of fixed sectors to the field to be measured. One paper describing this form is by Dahl[4] in which the field in the neighbourhood of an earthed terminal may be measured. An earthed rotor disk with sector stator is arranged to rotate in an aperture in an earthed plate at the surface where the field is to be measured. Located behind the rotating disk are fixed sectors of the same shape as the rotor slots, these being successively screened and opened to the field. From the fixed sectors and the rotor shaft are taken leads which carry the induced alternating e.m.f., as shown in Fig. 4. The induced e.m.f. is small, but is readily amplified by some simple form of a.c. amplifier and applied to a moving-coil indicating instrument. Alternatively a synchronous commutator may be employed and a moving-coil millivoltmeter used where the field is sufficiently strong.

The quantity of electricity induced will vary cyclically and will follow a saw-tooth form with time. Differentiating this to obtain current results in a rectangular waveform which is symmetrical about the zero line. This square-wave current is fed into a network comprising a resistance and capacitance in parallel, the generator being effectively of infinite impedance. The values of R and C determine the time constant, which may be varied over a wide range and modify the output waveform accordingly.

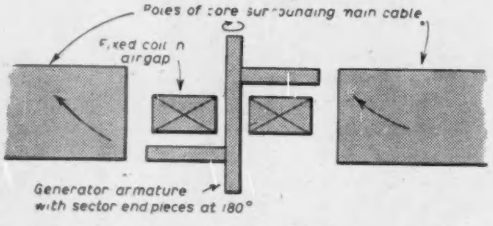


Fig. 2. Basic arrangement of the generating ammeter developed by the British Iron & Steel Research Association for measuring heavy currents

Fig. 3. Measuring electric fields can be effected using generating instruments of which this is an elementary form

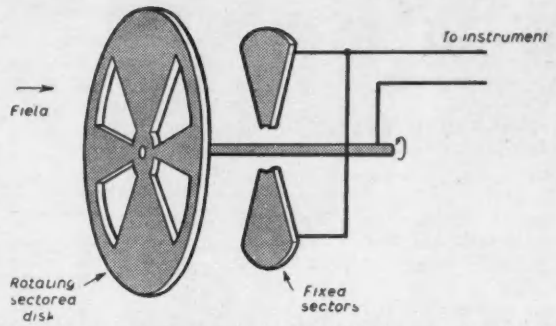


Fig. 4. Generating voltmeter developed by Dahl for measuring electric fields in the neighbourhood of an earthed terminal. The cutout sectors subtend an angle of 45° at the centre

Four different methods of indication are considered by Dahl, these being: (1) synchronous commutator and moving-oil indicator, (2) non-selective amplifier and square-law indicator (such as a thermal instrument), (3) non-selective amplifier and a peak-reading valve voltmeter, and (4) selective amplifier, tuned to a fundamental of the current from the fixed sectors, in conjunction with a rectifier or other a.c. instrument. In all cases sensitivity depends on resistance R and frequency f and at small values of the product f R it is largely independent of capacitance. In practice f R may be about 10^8, with C some 500 pF, without affecting the sensitivity. For strong fields, where sensitivity is not required, f R may be small. Using a value for f of about 100, requires a value for R of only about one megohm, which removes the need for very high insulation resistance.

A further development of the electrostatic generating voltmeter employs a fixed and a moving grid in which the capacitance between them varies as the outer grid moves. In one form the outer grid is vibrated laterally, alternately screening and exposing the fixed grid from the field being measured. The form due to Beckman,[5] however, employs an outer wire grid which is vibrated in a plane coaxial to the field being measured, so that the capacitance C between the grids and a fixed plate varies cyclically (Fig. 5). The output is applied to a resistance prior to valve amplification, the voltage being proportional to the voltage across the field being measured, the rate of change of capacitance, and the resistance, or $v = V\frac{dC}{dt}R$

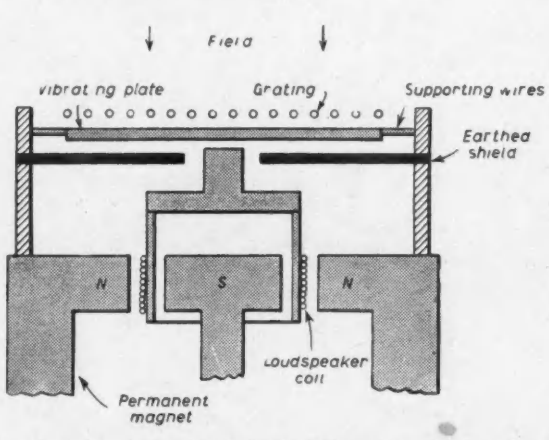


Fig. 5. Beckman's generating electric field meter in which a plate is vibrated with respect to a fixed grating using a moving coil as the means to obtain vibrations

In practice the grid is vibrated at its natural frequency by a coil in the air-gap of an iron-cored electromagnet fed at the correct frequency—the movement of a moving-coil loud speaker. One method is to apply a small direct voltage to the grid, then the voltage which is necessary to reduce the valve anode current to zero is proportional to the high voltage. It is thus used as a null method, but a further modification to the circuit produces a direct-reading instrument.

REFERENCES

1. W. H. Bailey: "Non-contact d.c. ammeter," Elect. Rev., vol. 153 (1953), pages 397-400.

2. P. Kirkpatrick: "Further development of the rotary voltmeter," Rev. Sci. Instrum., vol. 3 (1932), pages 430-8.

3. E. H. Greibach: "A generating voltmeter of extremely high sensitivity," Rev. Sci. Instrum., vol. 12 (1941), pages 472-7.

4. H. Dahl: "On the sensitivity of generating electrostatic d.c. voltmeters." Beretn. Michelsens Inst. Vidensk, vol. 14 (1951), pages 3-21. (In English.)

5. O. Beckman: "A generating voltmeter." Arkiv för Fysik, vol. 1 (1949), pages 329-33. (In English.)

NEW E.L.M.A. FLUORESCENT LAMPS

IT is announced by the Electric Lamp Manufacturers' Association that on 1st March, its members are introducing a lamp with a new colour and at the same time will be making a considerable improvement in the efficiency of "Warm-White" lamps. The new colour, known as "Deluxe Warm White" has been developed after prolonged research by E.L.M.A. members and will have a special appeal as an illuminant for "social" lighting. In appearance the light resembles that of tungsten filament lamps and has a similar colour rendition; one immediate advantage, therefore, is that it can blend most satisfactorily with light from tungsten filament lamps.

Practical experiments, which have been carried out with this form of lighting show that it is eminently suited for the illumination of premises where members of the public congregate either for leisure or business. Thus it is particularly applicable in homes, restaurants, hotels and shops. The "Deluxe Warm White" will be available in all the usual sizes, and the 80 watt lamp (type MCF/U) will cost 14s. 6d.

As far as the "Warm White" lamp is concerned, the efficiency has been improved—in the 80 watt size by as much as 15% and at the same time the colour appearance will be better. Prices will be unchanged and to ensure that these lamps are obtained it is essential that they should be ordered as "New Warm White."

Thus a further step has been taken in the continuous progress made in the development of fluorescent tubes. The first tubes were primarily designd for industrial use and this was met by the introduction of "Daylight." While eminently suited for its design purpose the light produced by "daylight" was, however, regarded as too "cold" for normal commercial use, and the next stage was the production of "Warm White" with a high efficiency but a warmer effect. The colour rendering of these lamps, however, varied widely from that of tungsten lighting and two more colours followed—"Natural" and "Mellow." These had a somewhat lower efficiency, and were frequently used for general lighting where tungsten lamps were also required. A certain amount of criticism still arose due to the lack of colour harmony between the fluorescent and tungsten lamps, and this led to the development of the "Deluxe Warm White" which has an efficiency equal to that of "Mellow" which it replaces.

The lamps are of course available from all E.L.M.A. members, and it is understood that exports of the "Deluxe Warm White" have already been made to Norway.

Peat for Power in Scotland

Gas Turbine Installations recommended by Home Department Committee

PROPOSALS that the North of Scotland Hydro-Electric Board should bring into operation two peat-fuel gas turbo-alternators are made in the report of the Scottish Peat Committee to the Secretary of State for Scotland, published* last week. It is suggested that the Board should be invited to order a 2,000 kW closed-cycle gas turbine and install it at Altnabreac Moss, Caithness, and that the 750 kW open-cycle gas turbine manufactured for the Ministry of Fuel and Power by Ruston and Hornsby should similarly be operated at Altnabreac in due course. The report in which these recommendations are made was signed on 31 July last year.

When it was set up in 1949, the Scottish Peat Committee was required to advise the Secretary of State on three matters. These were a survey of Scottish peat deposits; a programme of research into the burning of peat in gas turbines for the production of electric power; and the commercial exploitation of Scottish peat reserves. A peat moss or peat bog of the type with which the Committee is concerned is an extensive accumulation of plant remains which have been prevented from decaying in the usual way by becoming waterlogged. Peat is almost entirely composed of organic matter; if the ash (mineral) content of a peaty soil is over 40%, it is not regarded as true peat; and true peat must be at least 2 ft deep. On this basis the total area in Scotland is 1,625,000 acres. The total amount of dry matter is approximately 1,100m tons of which 600m tons should be workable.

The advantages offered by the gas turbine for use in Scotland are relatively small cooling water requirements; that the gas turbine offers possibilities of becoming more economic than a steam plant in the small sizes appropriate to many peat deposits; peat is especially promising as a gas turbine fuel because of its low ash content; and the gas turbine may have higher thermal efficiency.

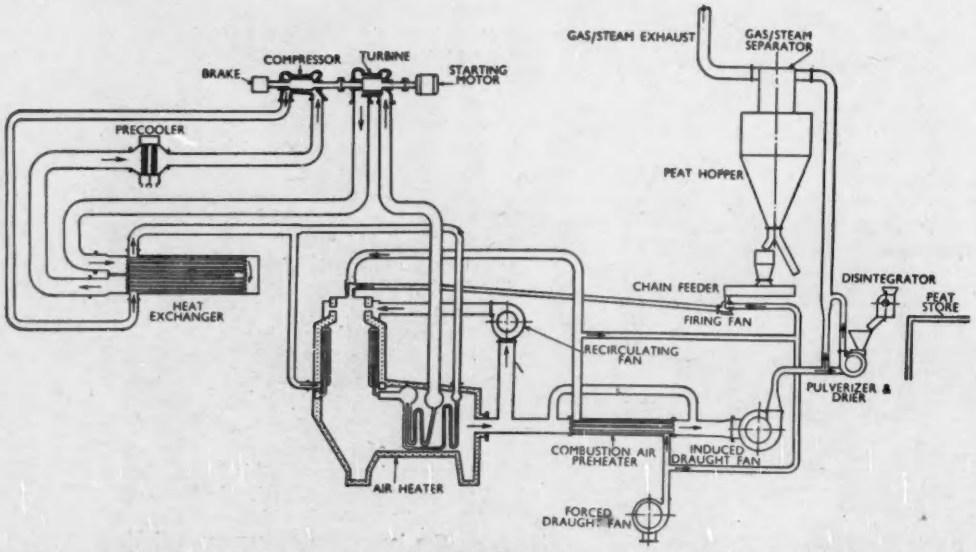
*Published by H.M.S.O., price 5s.

Research into a closed-cycle gas turbine has been carried out by Messrs John Brown and Co. After development work, this was placed on a 1,000 hour endurance run in 1952. At the end of the run, the air heater of the gas turbine had collected a fair deposit of ash on radiant tubes in the combustion chamber and on the early rows of the convection bank. The ash was found to be soft and easily removable by soot-blowing. Satisfaction is expressed with the air heater from the technical viewpoint, and it is considered possible that a reliable peat-fired air heater can be devised for continuous operation with a closed-cycle gas turbine. The plant in its present form has a flue-gas drying equipment which can dry peat from 50/55 to 30% moisture content, at which it can be accepted for combustion. If the heat rejected by the gas turbine coolers could be recovered, the peat could be dried from 75% moisture. Work on developing a suitable dryer is proceeding.

For the open-cycle peat-burning turbine developed by Messrs Ruston and Hornsby, an adaptation was made of that firm's oil-fired gas turbine. The peat turbine includes the same rotating components as the oil-fired design, but there is a special combustion chamber and associated equipment. Prolonged running using an Incandescent Heat Co. pump to feed in the peat began in March 1953, and a rotary louvre drier has been ordered.

Details of Turbines

The Ruston and Hornsby turbine has been described in the ELECTRICAL TIMES in some detail, and so more attention will be given to the closed-cycle design. In this there are five principal parts, turbine compressor, and brake to absorb the power produced; air heater and heat interchanger—all of them operate on a clean air cycle; and pulveriser and flue gas drier (preparing the peat for combustion) and combustion air pre-heater (utilising heat from the flue gases).



Diagrammatic lay-out of experimental peat burning closed cycle gas turbine. There are five principal parts; the turbine and compressor, with its brake; the air heater and heat interchanger; the pulveriser and flue gas drier; and the combustion air pre-heater. The first two operate on a clean air cycle

Tests were made with 35% moisture-content peat. The peat after being granulated was pulverised in an atritor mill in an atmosphere of hot flue gas. It then entered the main flue gas stream and passed up the drying tube, in which much of the water in the peat is evaporated. The mixture of peat, flue gas and steam was discharged into a separator at the top of the peat hopper. The peat fell into the hopper and flue gas and steam were discharged to the atmosphere. The pulveriser operated at about 450°F., and gave an output of peat sized so that 30-40% passes through a 200 mesh sieve.

Peat was drawn from the hopper on a chain feeder and passed to a firing fan which blew it into a 16 nozzle multi-jet burner at the top of the combustion chamber, where "secondary" air from the combustion air pre-heater was also introduced. The flame passed straight down the combustion chamber radiating heat to air tubes lining the vertical walls, these absorbing about 30% of the total heat given up to the closed-cycle air in the air heater. At the bottom of a chamber the gases took a right-angled turn, which ensured that most of the ash was thrown down into a fine form. At this stage the gases entered the two banks of convection air tubes. The mass flow of air at full load was about 9·3 lb/sec, and the leaving air temperature 1,100°F.

Hot air from the air heater was expanded in the impulse type turbine with seven stages and shrouded rotor blades, the compressor being an axial flow machine with 21 stages and a compressor ratio of 3·5 to 1. Maximum speed is 6,000 r.p.m. It is stated that "the compressor did not come up to expectations," and this reduced the power output, though this was of little importance for experimental purposes.

The Committee concludes that very satisfactory progress has been made with both types of turbine. From the thermo-dynamic point of view, there is little to choose between the two cycles.

Recommendations

The recommendations noted at the beginning of this article are based on estimates that the total capital cost of a 2,000 kW closed-cycle gas turbine plant is £368,000, giving a cost of power of 1·9d./kWh at 43% load factor, using milled peat. This compares well with the existing diesel stations of comparable output. The N. of S. H-E. Board have offered to undertake the operation of a plant if the capital cost can be met from other sources. No costs are estimated in the report for the open-cycle turbine.

Work on presses to dry the peat are regarded as being of great importance. It is felt that if a gas turbine can be shown to dry peat from 70 to 75% moisture without sacrificing thermal efficiency, and a reliable and cheap press can be discovered for reducing raw peat to this moisture content, then it should be possible for the large-scale development of peat to be thoroughly economical.

Current Ratings of Aluminium Cables

C.M.A. Issues Correction factors for E.R.A. Report F/T. 128.

ALUMINIUM can be employed in the production of power cables either for the conductors, or to provide a protective sheath, or for both purposes. Cables with aluminium conductors have a lower rating than copper conductor cables because the resistivity of aluminium is higher than that of copper. When aluminium is used for the sheathing, the sheath losses are increased as compared with lead-sheathed cables, because of the lower resistivity of the aluminium. This is taken into account in new tables which have been prepared by the technical committees of the Cable Makers' Association.

Tables of rating factors have been prepared in order to obtain the maximum currents for aluminium type paper-insulated power cables of the following constructions:—(*a*) Copper-conductor with aluminium-sheath; (*b*) Aluminium conductor with lead sheath; (*c*) Aluminium conductor with aluminium sheath.

These factors are applicable to the normal current ratings established by the E.R.A. and published in Report F/T.128, for copper-conductor lead-sheathed cables, and the particular reference concerned is indicated for each table.

The conductor strands and insulation thicknesses for cables with aluminium conductors are the same as those for the same sizes and types of copper conductor cables. The thicknesses of aluminium sheaths are in accordance with current practice and will be included in future British Standards. It has been assumed that aluminium-sheathed cables are unarmoured in all cases.

The conditions of installation and general assumptions made with respect to cables ratings are those given in the E.R.A. Report F/T.128. The maximum conductor temperatures for aluminium cables remain the same as those specified in F/T.128, with the exception of aluminium-sheathed cables installed in ducts which are allowed the same maximum temperature as armoured lead-sheathed cables in ducts.

It should be noted, therefore, that in all cases the same maximum temperatures are permitted with aluminium sheathed cables as with the equivalent armoured lead sheathed cables. The increased loss consequent upon the lower resistivity as compared with a lead sheath, however, is responsible for a reduction in rating, particularly with large-sized cables. The rating factors in the following tables will not be affected to any appreciable great extent by changes in basic ratings of maximum operating temperatures.

Note: Report F/T.128 is the fundamental E.R.A. Report on which the great majority of tables listing the current carrying capacity of copper cables of various types and sections are based. These include manufacturers' and other standards.

TABLE I.—CABLES FOR D.C. SYSTEMS
CURRENT RATING FACTORS FOR CABLES HAVING ALUMINIUM CONDUCTORS AND/OR ALUMINIUM SHEATHS

	Copper Conductor Aluminium Sheath	Aluminium Conductor Lead Sheath	Aluminium Conductor Aluminium Sheath
ALL TYPES AND ALL CONDITIONS OF INSTALLATION WITH THE EXCEPTION OF ALUMINIUM-SHEATHED CABLES IN DUCTS—ALL SIZES:			
Factors to be applied to values given in F/T.128 for cables with similar finishes	1·0	0·78	0·78
ALUMINIUM-SHEATHED CABLES IN DUCTS—ALL SIZES:			
Single-core: Factors to be applied to values given in Col. 2, Table VII, F/T.128 ..	0·97	—	0·75
Multicore: Factors to be applied to values given in F/T.128 for armoured cables ..	1·0	—	0·78

TABLE II.—SINGLE CORE CABLES

CURRENT RATING FACTORS FOR CABLES HAVING ALUMINIUM CONDUCTORS AND/OR ALUMINIUM SHEATHS. (A.C. SYSTEMS ONLY)

	Copper Conductor Aluminium Sheath			Aluminium Conductor Lead Sheath			Aluminium Conductor Aluminium Sheath		
	Conductor Area sq. in.	Factor		Conductor Area sq. in.	Factor		Conductor Area sq. in.	Factor	
LAID DIRECT (SERVED) ALL VOLTAGES: Factors applicable to values given in Cols. 3, 4, 5 and 6. Table I. F/T.128.	Up to 0·25	0·97		Up to 0·30	0·78		Up to 0·15	0·78	
	0·30–0·40	0·94		0·40–0·50	0·79		0·20–0·25	0·77	
	0·50	0·91		0·60	0·80		0·30–0·40	0·76	
	0·60	0·87		0·75	0·81		0·50	0·75	
	0·75	0·84		1·00	0·83		0·60–0·75	0·73	
	1·00	0·80					1·00	0·72	
IN DUCTS* (SERVED)—ALL VOLTAGES EXCEPT WHERE OTHERWISE STATED:		Up to 11 kV.	22 kV.						
Factors applicable to values given in Cols. 4, 5 and 6. Table VII. F/T.128.	Up to 0·10	1·20	1·15	Up to 0·15	0·78		Up to 0·15	0·92	
	0·15–0·20	1·12	1·07	0·20–0·30	0·79		0·20	0·89	
	0·25–0·30	1·07	1·02	0·40	0·80		0·25–0·30	0·87	
	0·40–0·50	1·01	1·01	0·50–0·60	0·81		0·40–1·00	0·84	
	0·60–0·75	0·99	0·99	0·75	0·83				
	1·00	0·95	0·95	1·00	0·85				
IN AIR (SERVED) ALL VOLTAGES: Factors applicable to values given in Cols. 3–9. Table XIII. F/T.128.	Up to 0·40	0·95		Up to 0·30	0·78		Up to 0·10	0·77	
	0·50	0·92		0·40–0·50	0·79		0·20–0·40	0·76	
	0·60–0·75	0·87		0·60	0·80		0·50–0·60	0·75	
	1·00	0·82		0·75	0·81		0·75	0·73	
				1·00	0·83		1·00	0·72	
IN AIR (SHEATH LEFT BARE) ALL VOLTAGES: Factors applicable to values given in Cols. 3–9. Table XIII. F/T.128.		Trefoil	Flat		Trefoil	Flat		Trefoil	Flat
	Up to 0·0225	0·84	0·84	Up to 0·30	0·72	0·74	Up to 0·10	0·70	0·70
	0·04–0·40	0·90	0·90	0·40–0·50	0·75	0·77	0·15–025	0·71	0·71
	0·50–0·60	0·86	0·86	0·60	0·76	0·78	0·30–0·60	0·72	0·72
	0·75–1·00	0·82	0·84	0·75	0·77	0·79	0·75–1·00	0·72	0·74
				1·00	0·80	0·84			

*Maximum conductor temperature for single core aluminium sheathed cables up to 11 kV. 70° C. Above 11 kV. 65° C.
Maximum conductor temperature for lead sheathed cables, all voltages, 50° C.

TABLE III.—MULTICORE CABLES

CURRENT RATING FACTORS FOR CABLES HAVING ALUMINIUM CONDUCTORS AND/OR ALUMINIUM SHEATHS. (A.C. SYSTEMS ONLY). EXCLUDING S.L. TYPES

	Copper Conductor Aluminium Sheath		Aluminium Conductor Lead Sheath		Aluminium Conductor Aluminium Sheath	
	Conductor Area sq. in.	Factor	Conductor Area sq. in.	Factor	Conductor Area sq. in.	Factor
LAID DIRECT (SERVED). ALL VOLTAGES: Factors applicable to values given in F/T.128 for armoured and served cables.	Up to 0·60	1·00	* Up to 0·20	* 0·78	Up to 0·20	0·78
	0·75	0·99	0·25–0·30	0·79	0·25–0·40	0·79
	1·00	0·98	0·40–0·50	0·80	0·50–0·60	0·81
			0·60	0·91	0·75	0·82
			0·75	0·82	1·00	0·85
			1·00	0·85		
IN DUCTS (SERVED). ALL VOLTAGES: Factors applicable to values given in F/T.128 for armoured and served cables.	Up to 0·50	1·00	* Up to 0·20	* 0·78	Up to 0·25	0·78
			0·25–0·30	0·79	0·30–0·50	0·79
			0·40–0·50	0·80		
IN AIR (SERVED). ALL VOLTAGES: Factors applicable to values given in F/T.128 for armoured and served cables.	Up to 0·50	1·00	* Up to 0·20	* 0·78	Up to 0·10	0·78
	0·60–1·00	0·99	0·25–0·30	0·79	0·15–0·30	0·79
			0·40–0·50	0·80	0·40–0·50	0·81
			0·60	0·81	0·60	0·81
			0·75	0·82	0·75	0·82
			1·00	0·85	1·00	0·85
IN AIR (SHEATH LEFT BARE). ALL VOLTAGES: Factors applicable to values given in F/T.128 for armoured and served cables.	Up to 0·30	0·96	* Up to 0·20	0·75	Up to 0·10	0·75
	0·40–1·00	0·98	0·25–0·30	0·76	0·15–0·30	0·76
			0·40–0·50	0·81	0·40	0·77
			0·60	0·83	0·50	0·78
			0·75	0·84	0·60	0·79
			1·00	0·89	0·75	0·81
					1·00	0·84

*Factors for conductor sizes above 0·5 sq. in. apply to L.T. cables only.
Armoured and served cables. For unarmoured and served, and bare wire armoured cables the various factors given in F/T.128 for these types must also be applied.

TABLE IV.—S.L. TYPE CABLES

CURRENT RATING FACTORS FOR CABLES HAVING ALUMINIUM CONDUCTOR AND/OR ALUMINIUM SHEATHS (A.C. SYSTEMS ONLY)

	Copper Conductor Aluminium Sheath		Aluminium Conductor Lead Sheath		Aluminium Conductor Aluminium Sheath	
	Conductor Area sq. in.	Factor	Conductor Area sq. in.	Factor	Conductor Area sq. in.	Factor
LAID DIRECT (ARMOURED AND SERVED): Factors applicable to values given in F/T.128 for armoured and served cables.	Up to 0·10	0·99	Up to 0·25	0·78	Up to 0·10	0·78
	0·15–0·20	0·97	0·30	0·79	0·15–0·40	0·77
	0·25	0·96	0·40	0·80	0·50–0·60	0·76
	0·30	0·95	0·50	0·81		
	0·40	0·93	0·60	0·82		
	0·50	0·92				
	0·60	0·91				
IN DUCTS (ARMOURED AND SERVED): Factors applicable to values given in F/T.128 for armoured and served cables.	Up to 0·10	0·98	Up to 0·25	0·78	Up to 0·60	0·77
	0·15–0·20	0·97	0·30	0·79		
	0·25	0·96	0·40	0·80		
	0·30	0·95	0·50	0·81		
	0·40	0·93	0·60	0·82		
	0·50–0·30	0·91				
IN AIR (ARMOURED AND SERVED): Factors applicable to values given in F/T.128 for armoured and served cables.	Up to 0·10	0·99	Up to 0·25	0·78	Up to 0·60	0·77
	0·15–0·20	0·98	0·30	0·79		
	0·25–0·30	0·97	0·40	0·80		
	0·40	0·95	0·50–0·60	0·81		
	0·50	0·94				
	0·60	0·93				

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor.

Status of the Engineer

WHILST wishing the Electrical Power Engineers' Association every success in its efforts to bring about improvements in the salaries of engineers in electricity supply, one may venture to hope that those efforts will not be accompanied by an attempt to belittle the status and functions of what your correspondent "District Manager" described as the "non-technical administrator," in which category he would no doubt include Secretaries, Accountants, Solicitors and others.

It would be a great misfortune from the point of view both of efficiency and good relations amongst staff if one section sought to establish that it was in some way superior to the others, and thus entitled to greater consideration.

Few people are likely to question the fact that engineers have played a major part in the building up of the electricity supply industry. In the early days they were almost entirely responsible for its planning and operation and right up to vesting day they were in control, most of the chief officers of supply undertakings being engineers by profession. But long before 1948 there was general recognition that the functions of those at the top were increasingly managerial and less technical and that success in an undertaking depended as much on good managerial qualities as on technical ability. As the industry increased in size and complexity, the managerial function became more important, and when the industry was brought under public control in 1948, giving rise to difficult problems of organisation and co-ordination, good management, as well as engineering skill, was manifestly essential.

Today the industry is being run, not by engineers only, but by various people, who may be Secretaries, Accountants, Solicitors or members of other professions, but whose contributions in their own spheres are equally as important and whose services are just as requisite to success. Whilst it is abundantly true that the industry cannot be carried on without engineers (in fact the writer would agree that they are its backbone) it is just as true that it cannot function without the administrator or the accountant. Each has his proper place and importance.

It would be quite wrong for engineers to conceive themselves as being superior to those in other professions. They are entitled to their rightful place as professional men; they have fought hard for this, and the E.P.E.A. undoubtedly deserves a great deal of the credit, but *qua* engineers, they cannot claim to be better than those in the non-engineering professions.

If they are to establish a claim for a comparatively higher remuneration, it can only be on the basis that their responsibilities are greater or that their work calls for superior effort or qualities. In the writer's opinion, the strength of their case must rest on the fact that many engineers are occupying positions involving a high degree of managerial responsibility. They are not only engineers, but managers, and their competency in their jobs depends as much upon their qualities as managers as on their technical ability. This is true of Sub-Area Managers, Chief Generation Engineers, District Managers and Power Station Superintendents. Their problems are not only engineering, but of co-ordination and human relations. Their failure in the latter may more than offset their brilliance as technical specialists.

This applies not only to engineers but to others in the higher ranks of the industry. In short, it is the ability of a person as a manager, which in many of the higher executive positions is the real test of his worth, and which should determine his remuneration.

The industry has not yet got down to a proper method of assessment of this, but it must ultimately do so. It is with this aspect that the Association of Managerial Electrical Executive is primarily concerned. It came into being in order that managers of undertakings, who had frequently to negotiate with their staffs, would have a separate Association of their own. Its basis of membership has been widened since vesting date to include others besides engineers who occupy managerial positions. They have joined with their colleagues to enable them to voice their collective views and to ensure that their interests as managers are promoted.

There is no reason for antagonism between those holding executive positions in the industry, whether they be engineers or non-engineering administrators, as all have their rightful place and importance. The aim of the A.M.E.E. is to see that salaries are determined by responsibility, capacity and worth, regardless of the profession to which the occupant of the position may belong. It believes that it is as capable of doing this as a body composed entirely of engineers on the one hand or of clerical and administrative workers on the other.

"District Manager" may be interested to know that his views are not shared by District Managers generally, as a large majority of them are members of the A.M.E.E.

J. W. Thomas, B.SC., LL.B., M.I.E.E.
SECRETARY,
ASSOCIATION OF MANAGERIAL ELECTRICAL EXECUTIVE
LONDON, S.W.1.

Unearthed Overhead Lines

IT is some eight years since the issue of B.S. 1320 and the general adoption of h.v. overhead lines without earthing or bonding, and a review of the experience of such lines and their behaviour, gained over this period, would be both illuminating and profitable.

One hears of pole fires being caused by h.v. leakages, and it would be interesting to know how frequent are these occurrences.

The use of lightning arresters is continued, and the number of insulator discs has been increased from one to two at terminal positions. Has the omission of the earthwire resulted in a greater susceptibility to flashover or breakdown of transformers or cable boxes at such positions?

The most serious criticism of the unearthed overhead line comes from that school of thought that advocates bonding the transformer l.v. neutral earth to the continuous earth wire of the h.v. overhead line, thereby obtaining at very low cost a neutral earth of extremely low resistance. The other school that opposes this calls for the widest possible separation between the earth resistance areas of the h.v. and l.v. respectively, fearing that a leakage on the h.v. line would impress a dangerous voltage on the l.v. system. It has been shown by operation over many years with l.v. neutrals bonded to continuous earthwires of h.v. overhead lines that, owing to the low resistance values obtained and the consequent positive and rapid clearance of both h.v. and l.v. faults, this danger is but hypothetical, and that, in point of fact, greater overall safety

arises from this practice. This condition is generally found with underground systems when the respective sheaths and armouring of the h.v. and l.v. cables are bonded together by the tank of the transformer, and to follow a contrary policy with overhead lines appears quite illogical. Furthermore, the provision of an independent earth of an adequately low resistance value at each transformer substation can, in difficult situations, be extremely costly. For a transformer of fairly high rating where there is a gravel subsoil, £150 is by no means an exaggerated statement of cost.

F. P. Meadows, B.SC., A.M.I.E.E.
STAINES.
MIDDLESEX.

Painting or Galvanising?

I WAS very interested to read *Megohm's* comments in your issue for 11th February, but would point out that in some cases galvanised conduit is less resistant to corrosion than is enamelled conduit; depending upon the type of plaster or floor fill used, it is quite possible that red oxide painted conduits would have a longer life than galvanised. In reply to *Megohm's* query as to which of the two methods is preferable in keeping installation costs to the minimum the answer must be—neither, but rather to use non-metallic conduit which needs no such costly preparation as described and yet is completely impervious to the very worst the corrosion bugs can do.

Regarding his comment that lightning may have damaged the trip coil of an earth leakage circuit-breaker, this is quite possible. Early types of these devices were particularly prone to this kind of damage, due, in my opinion, to mistaken attempts to keep tripping currents to excessively low values, whereby long fine windings were employed on the trip coils. The trouble was found to be purely mechanical, that is, if a trip coil were wound with reasonably stout wire the disruptive discharge from a lightning secondary would pass over the ends of the windings, like a multiple spark gap, without destroying the coil, and with the adoption today of higher tripping currents, manufacturers inform me that damage due to lightning has practically disappeared.

I would strongly support *Megohm's* reiterated comment as to the necessity for frequent check of earth leakage circuit-breakers; without this, protection can be little better than the old haphazard direct earth.

T. C. Gilbert, M.I.E.E.
FOLKESTONE,
KENT.

TV and Lightning

I WONDER what steps have been taken regarding what appears to me to be a potential danger from lightning striking any of the television aerials that are usually fixed to the highest points on buildings, in particular high buildings on high ground. Some of the aerials I have seen have been fixed higher than near-by lightning conductors.

One is on the top of a fire station hose drying and drilling stack, which is some 40 ft higher than the surrounding buildings. There is also one on a block of lock-up shops which has a two-storey block of flats on top, where radio dealers have installed a large and complicated TV aerial. Surely there is a danger also with just the ordinary household TV aerial way up higher than the chimney pots.

B. P. Meade.
TOLWORTH.

Teaching Electromagnetic Theory

New Approach to Fundamentals Suggested in I.E.E. Paper

A MOST interesting paper suggesting a new approach to the vexed question of electrical units was presented last week to an Extra Meeting of the I.E.E. by Mr P. Hammond. The paper, entitled "A Short Modern Review of Fundamental Electromagnetic Theory" attacked the subject by elucidating the concept of dimensions. It is pointed out that the three dimensions of length, mass and time are quite arbitrary, and that in their use certain assumptions are made by the suppression of a host of dimensional constants. Under such conditions, electrical problems are not readily amenable to simple treatment, and consistency can only be attained by additional concepts. These have been suppressed by asserting that the electric constant, κ_0 and the magnetic constant, μ_0 are both unity in vacuo. As the electrical and magnetic concepts are not independent of one another, the two systems are not consistent and it is generally necessary to use both.

It is suggested in the paper that the starting point should be the inverse square law, and that from this point an approach may be developed toward electrical quantities which retains the symmetry of the magnetostatic and electrostatic systems.

Discussion

The discussion was opened by Professor G. W. O. Howe, who queried the author's subdivision into two parts of the field in the air gap of a machine consisting of a smooth cylindrical armature rotating between opposite poles. He thought there was no necessity for splitting the field into two components, one rotating and one stationary. Professor R. O. Kapp pointed out that although the inverse square law was a stepping stone, it was difficult to demonstrate. He also emphasised that by using parallel plates a law could be obtained independent of the distance, and this was just as fundamental as the inverse square law. Mr B. Adkins did not think that the introduction of more complex—although more rigorous concepts—would help the student much, while Professor J. Greig held that many ambiguities in regard to induced e.m.f., particularly under transformer conditions, resulted from lack of attention to the presence of conductors in the field.

Mr D. Edmundson spoke as a working engineer. When the M.K.S. system had been introduced he and others had been worried by the fact that they were being presented with a new concept. He thought that permeability as a basis for any system was fundamentally wrong. Ferromagnetism was in many ways an accident of nature.

Mr K. A. Macfadyen considered that much of the trouble lay in the concept of the ether developed by Maxwell and Faraday. The M.K.S. teaching sequence was of limited usefulness when it came to considering magnetised masses of iron. Dr K. J. R. Wilkinson said that the engineer was not a purist and was prepared to use any rule that worked, while Mr D. Connelly expressed the view that the flux-cutting and flux-threading rules were only part of something more fundamental. Mr R. Kitci said that all one could demand of a theory was that it should be not self-contradictory and that it should be useful, and Mr C. J. Carpenter suggested that apparent paradoxes raised by Faraday's disc and other problems could be explained by flux linkage if necessary.

The author briefly replied.

From an engineer's notebook

IN my browsing amongst scientific literature my eye suddenly jumped to the word "swindletron." Admittedly the word was in quotes, as though to apologise for scientific *lese-majesty*, it was used as an apt label for a new type of particle accelerator more decorously known as the charge exchange accelerator. This device functions from a source of negatively-charged hydrogen ions obtained by shooting positive charged ions at low speed (about 30 kV potential) through an electrically neutral aluminium foil whence they pick up the desired two electrons. The negative ions are then accelerated towards a second foil by the main accelerating potential which in the instrument described, was +500 kV. On passing through this positively-charged foil, the electrons are stripped from the ions, which emerge on the opposite side positive in polarity and are further accelerated by repulsion from the foil, to give a final acceleration equivalent to one million kV. This doubling of the energy output, or apparently obtaining something for nothing, is the reason for the apt title I mentioned in the beginning but older hands at such conjuring tricks may see the legerdemain in the electrons disappearing into the stripping foil without affecting its potential. None the less the device is attractive although I feel it will have a limited sphere of utility.

* * *

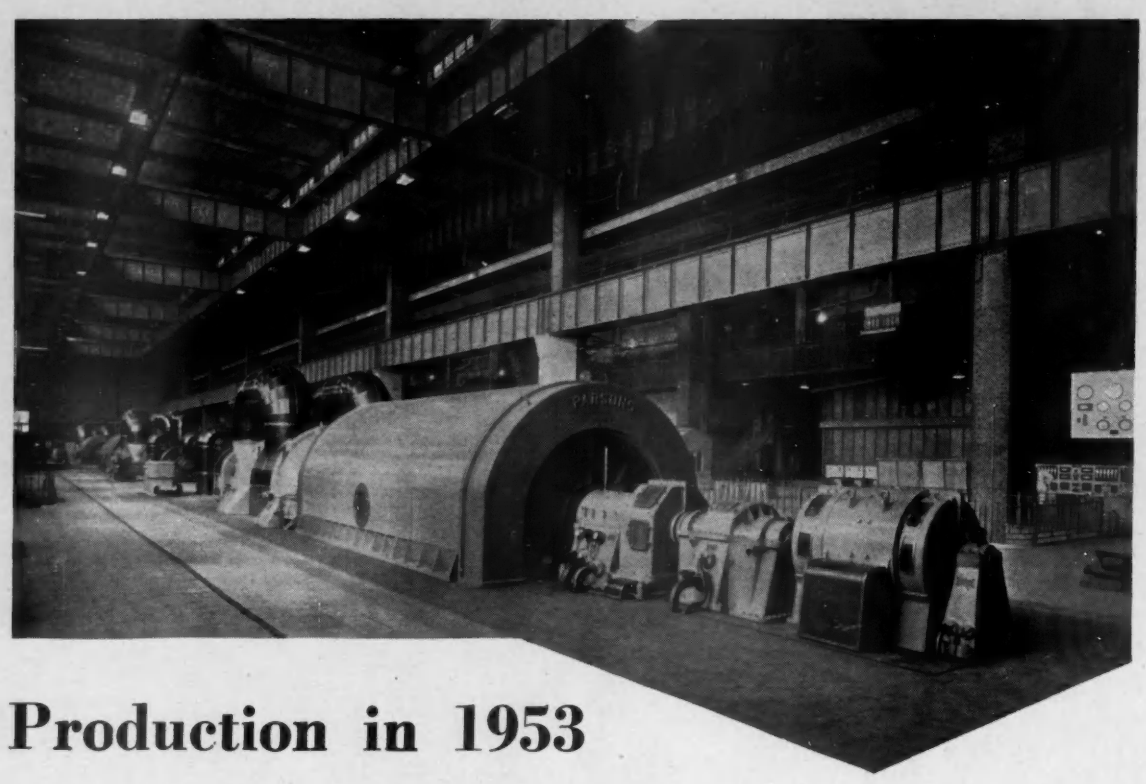
IN this century when we are all searching for mechanisms to work at higher speeds and barbitones to slow us down, it is unexpected to find scientific work being devoted to slowing down electric currents. Of course, delay lines are no new thing, though they are a crude means to this end. Much the same purpose is served by the use of an electrochemical method of transmission of electric signals that has recently been developed. It is intended for automatic switching systems where the pulse signal must be delayed until certain switching has been completed. The inspiration of this idea comes from a study of transmission in nerve fibres and the resulting speed of the signal is about one-millionth of that of an ordinary electric circuit. Briefly the circuit consists of a tube of nitric acid in which an iron wire is immersed. An input electrode is placed at the bottom of the tube, adjacent to the end of the wire, and output electrodes are arranged up the tube's side. When the wire is first immersed in the acid it is momentarily attacked until an oxide film is established. Then when an impulse is applied between the input electrode and the wire, this film breaks down, initiating a wave of chemical action which travels up the wire, for as the oxide film is restored it disrupts the film immediately above it. This results from the action equivalent to that of a short circuited voltaic cell in which the base iron is the anode and the oxide film the cathode. This area of disruption is said to be readily visible as a brown ring travelling up the wire, and results in the transmission of an electrical pulse where it reaches an output electrode, the distance between the input and output electrodes being a measure of the time delay.

THE transistor has for me the same magical quality that the copper oxide rectifier had when it was first introduced; I just can't believe my eyes. I feel I need no excuse therefore to return to the subject with a reported development in construction which is said to permit of operation at frequencies up to 70 Mc/s, and with low power consumption. The novelty lies in the method of construction which permits the use of thinner germanium films. In effect the slab of germanium is etched on opposite sides by small streams of a liquid indium salt carrying an electric current: this cuts away the germanium until when the desired thinness is obtained, the current is reversed. This immediately stops the etching and the reversed current flow causes the indium to be electroplated to form the electrodes. The advantage of this method lies in the precision of piercing the germanium which can be etched down to less than a thousandth of an inch and controlled to the astonishing tolerance of ten-millionths of an inch. Further, the plated electrode should provide greater stability than the less dignified cat's whiskers. Easy as it is to wax enthusiastic over these new devices, one needs a corrective reminder that there are always physical limitations to any device; in the passage of time many may be overcome and the present development appears to be a step in the right direction but whatever happens I shall always have a weakness for these wonders of the realm of semi-conductors.

* * *

CASTING must be the oldest method of working in metals and it is a sobering thought that our mechanised foundries employ methods that are not so very different from those used perhaps five thousand years ago. One of the more recent developments in casting technique has been the adaption to industrial production of a method that has been mainly used in the realm of art since the days of the early Egyptians. It is no more than the production of the pattern in wax so that when the mould has been formed round it, the wax can be melted and run out, leaving the mould ready for casting. For industrial use, the technique has been standardised and facilities added for casting the wax patterns in quantities for repetition work. Those who wish for further details, I would refer to an excellent article in Philips Technical Review in which is shown how several small parts can be cast at one time by mounting the patterns on the branches of a wax tree. This method appears to have excellent possibilities of meeting modern industrial demands. Twenty years ago it seemed that casting as a production method was fast losing ground in the face of the extended use of plastics and of fabrication methods. Now with the growing application of refractory metals for specialised purposes, casting is extending its scope into fields of production from which it has long been excluded.

E. R. G.



Production in 1953

A REVIEW OF OUTPUT, AND ORDERS DURING THE YEAR

IN the heavy generating plant sections of the principal manufacturing companies activity remained during 1953 at a high level. Much of this work was, of course, in connection with the B.E.A. expansion programme. The British Thomson-Houston Co., for example, put into commission some 225 MW of plant for the B.E.A. alone. Overseas, the company was responsible for a 25 MW hydrogen-cooled, double-extraction set for the Ford Motor Co. of Canada, and this unit was erected in the unusually short time of 9½ weeks—a time comparable with American best practice.

C. A. Parsons and Co. have received a large number of orders for turbo-generators of 30 and 60 MW for power stations in this country and have also had an order for the second 100 MW set for Ferrybridge. These two machines have steam conditions of 1,500 lb/sq in. 975° F. with reheat to 950° F. between the h.p. and i.p. cylinders. Turbo-generators completed or put into commercial operation during the year total over 1,000 MW, more than half of which were installed in Great Britain. Overseas, the fourth 100 MW set was completed at the Richard L. Hearn station, Canada. The English Electric Company also received confirmation of orders for two 100 MW, 1,500 lb/sq in. 1,050° F. turbo-alternators for Willington "A" power station. Other high pressure sets are the first of the 60 MW units for Stourport "B," which is now ready for commissioning and similar sets for Drakelow are well advanced in manufacture. Overseas two 66 MW sets have been commissioned in the Clark Keith power station at Windsor, Ontario.

Brush Electrical Engineering Co. report the despatch of two 8·75 MW sets for Bangkok, a 12·5 MW set for Kingston, Jamaica, and two 12·5 MW sets for Lagos, Nigeria.

C. A. Parsons & Co., Ltd. built these 60 MW sets which are now installed at North Tees power station

Some 160 MW of generating plant has been ordered from the General Electric Co. by the B.E.A. and industry. Particularly gratifying was the performance figure of the first of the Uskmouth sets, which, with a consumption of 9,027 B.Th.U./kWh is claimed to be operating at the highest efficiency yet recorded for a set of this size with steam conditions of 900 lb/sq in. at 900° F. Further 60 MW sets are on order for Bold "B" station and Hams Hall "C," bringing the total in course of construction for the latter station up to six.

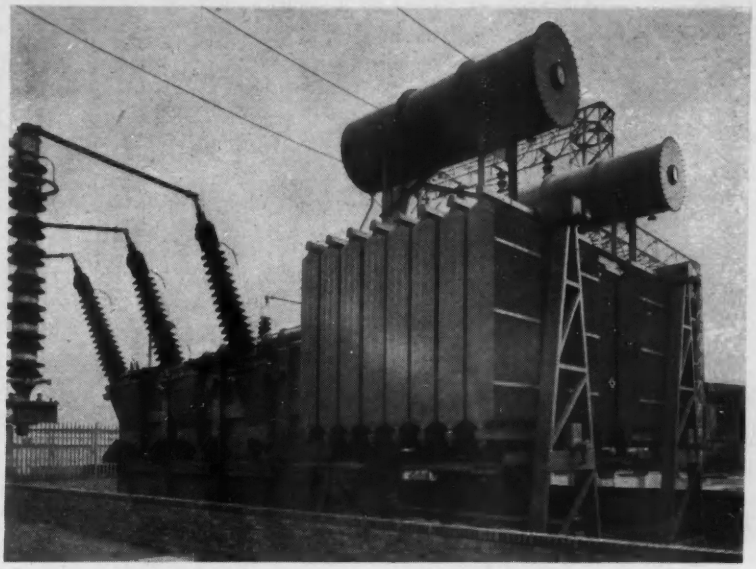
Over half the 785 MW of turbo-alternators produced by Metropolitan-Vickers Electrical Co., Ltd., went to the B.E.A. who took some 570 MW. The largest unit was the 100 MW cross-compound set for the extensions at Battersea "B." The commissioning of the seventh and last set at Clarence Dock brought that station up to its final capacity of 360 MW, all the plant being of Metropolitan-Vickers manufacture. Abroad the second of four 50 MW sets was commissioned at Sydney (Pyrmont B) where the steam conditions are 1,200 lb/sq in., 925° F. and these sets generate at 33 kV. Altogether some 22 turbine sets went into operation overseas, these ranging in output from 3 to 50 MW.

Hydro-Electric Plant

Among typical orders received during the year by the English Electric Co., were three 30,000 h.p. vertical shaft reaction turbines for Canada, and the American order for McNary Dam for two 108,000 h.p. water wheel generators. The John Inglis Co. have received orders for turbines to be manufactured by them in Canada to "English Electric" design, and these include one 3,000 h.p. turbine for Spillamacheen and four 150,000 h.p. turbines for Bersimis power station of the Quebec Hydro-Electric Commission.

Bruce Peebles and Co. have also been engaged in the production of hydro-electric plant, and installations in sizes up to 16,000 h.p. have been completed or are on order for various schemes in Norway, South Africa, Malaya and New Zealand. In the home market several generators are in hand in sizes up to 30,000 h.p. for the Scottish Highlands.

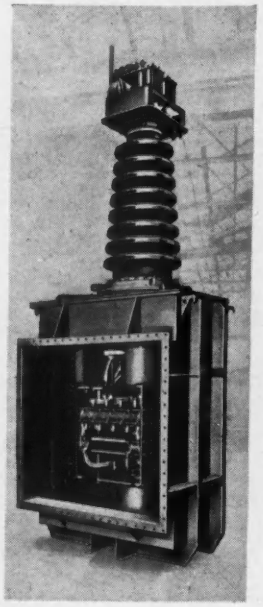
The project most in the public eye, as far as the British Thomson-Houston Co. is concerned, is Owen Falls where six 16,700 kVA alternators are to be installed. An unsual feature of these sets is the use of an electronic voltage regulator in conjunction with an amplidyne exciter set to provide a high-speed response. In Spain the installation of B.T.H. plant has proceeded satisfactorily: the first of the three 62·5 MVA alternators at Los Peares power station is now on commercial load, and the second is due to be commissioned early this year. Further sets are in course of manufacture in the works for Spain, Scotland, Australia, and New Zealand.



B.T.H. built this 120 MVA transformer for the 275 kV line between Staythorpe and West Melton

Two of five G.E.C. 25 MW, 600 r.p.m. vertical shaft alternators for the Tungatinah power station of the Tasmanian Hydro-Electric Commission have been put into service and the third is being erected. G.E.C. have also delivered the first of three 25 MW generators for the Errochty power station of the North of Scotland Hydro-Electric Board.

Several large hydro-electric machines were completed at Metropolitan-Vickers works. The last of four 17,100 kVA vertical shaft machines for Victoria (Kiewa No. 4) being among their number. Four large horizontal-shaft generators driven by Pelton wheels have also been completed—two of 37·5 MVA for Aura in Norway and two of 16 MVA for Pykara in Madras. Under construction are three 75 MVA, Francis-driven units for San Esteban and other large sets are being built for Aura, Whakamaru, Escales and Kiewa No. 1. The 75 MVA sets are, incidentally, the largest yet built at the company's Trafford Park Works.



Metrovick single-phase 132 kV type H on-load tap-changer

Gas Turbines

The M-V 15 MW gas turbo-generating set at Trafford power station has built up a considerable amount of running experience during the year and the 1,750 kW set for Shell Petroleum has completed acceptance tests at Pernis, Holland, where it has been running on refinery gas. A 2,500 kW standby set for the Metropolitan Water Board has also completed bench testing and has been delivered to site.

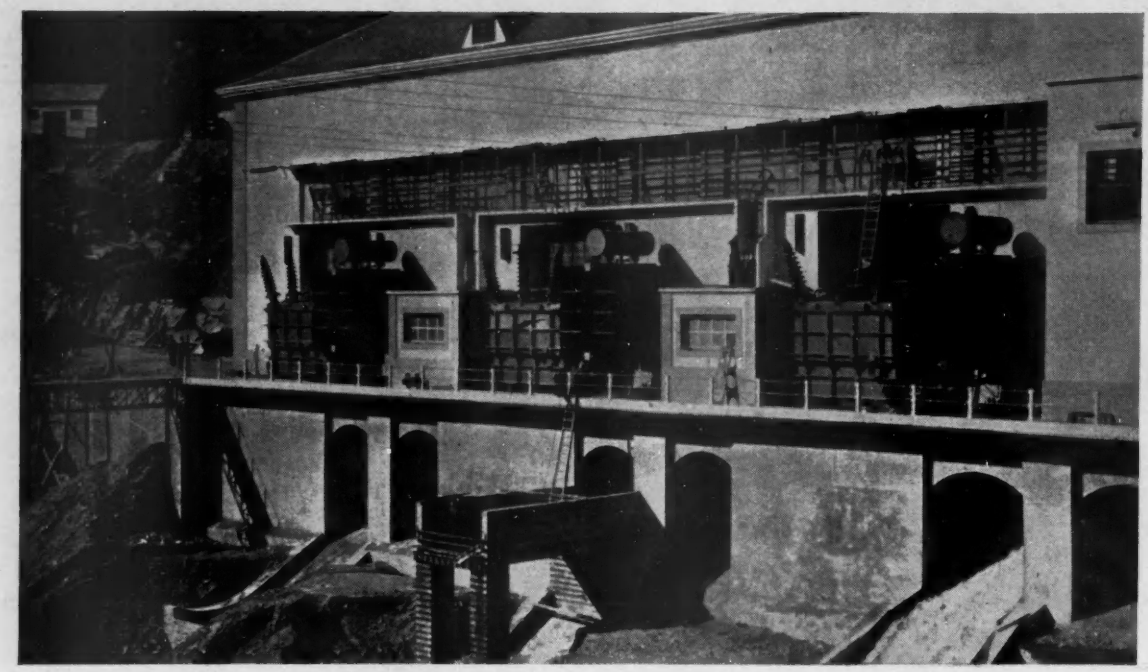
The first of two B.T.H. 2,500 kW gas turbo-alternator sets for Nairobi South power station was tested at Rugby and has been despatched to site for erection.

Transformers

The year 1953 was noteworthy for the putting into operation of the first section of the 275 kV "Supergrid," and one of the first 120 MVA 275/132 kV transformers to be commissioned at West Melton was made by English Electric. Orders were received for two 120 MVA generator transformers and for one of the first 106 MVA, 275 kV units for Willington station. Abroad, the company secured the contract for three 310 MVA 3-phase generator transformer banks, with twin primary windings to take the output of two generators, for the Chief Joseph Dam project of the U.S. Army Corps of Engineers. Another large order is for a 250 MVA 3-phase transformer bank, with on-load tap changing equipment for the Bonneville Power Administration.

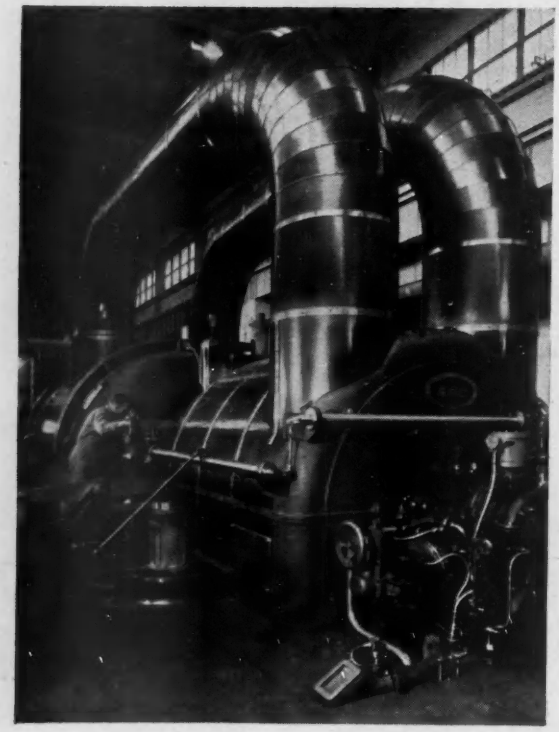
Supergrid transformers of 120 MVA are also being made by Bruce Peebles, B.T.H. and Metropolitan-Vickers. G.E.C. have delivered the first consignment of thirty 1,500 kVA air-cooled transformers to the Ministry of Supply which are not only vermin-proof but are equipped with hand-operated ventilating flaps interlocked with the circuit-breakers so that the transformers cannot be put on load unless the flaps are open. Automatic heaters prevent condensation when the transformers are not in use.

At C. A. Parsons and Co., Ltd., the new large transformer shop is now in full operation, and many large units are in hand. The majority of these are for direct connection to alternators, and include a second 120 MVA unit for Ferrybridge, two 72 MVA units for the power stations at Stella, and two further 36 MVA transformers for each of the power stations at Connah's Quay and East Yelland. Three of the largest transformers ever built by Parsons have also been despatched. These were single-phase units forming a three-phase 11/22/275 kV bank having an equivalent output of more than 200 MVA. The total weight of the bank, as installed at the Reyrolle switchgear testing station is about 500 tons.



The General Electric Company built these 16,000 kVA transformers now erected at Saltos del Sil Power Authority, Spain

One of the record breaking G.E.C. 60 MW hydrogen cooled turbo-alternators installed in Uskmouth power station



Switchgear

Switchgear has, of course, continued in demand both for home and for overseas markets. The English Electric Co. put in the 275 kV 7,500 MVA air-blast circuit-breaker in the Staythorpe line, and other air-blast breakers of 132 and 165 kV have been despatched to various parts of the world, including Tasmania, Australia, Canada, Spain and Holland.

G.E.C. announce that a new design of 132 kV outdoor oil circuit-breaker rated at 2,500 MVA, is now in production and large numbers are in hand for the B.E.A. The tanks have been considerably reduced so that the volume of oil required is small. Considerable quantities of heavy duty switchgear of the metal-clad type have been supplied by G.E.C. to overseas clients. A load-breaking, fault making oil switch has been developed and tested for ratings of 150 MVA at 6·6 and 250 MVA at 11 kV.

An important step forward in the development of oil circuit-breakers for 300 kV service and above was the successful testing by the Switchgear Testing Co. and by Electricité de France at Fontenay of the first B.T.H. production breakers for the State Electricity Commission of Victoria contract covering thirteen 220 kV 5,000 MVA shunt-arc oil circuit-breakers. Orders for bulk oil circuit-breakers received during 1953 included one from the North of Scotland Hydro-Electric Board for a three-switch 132 kV 1,500 MVA installation at Brechin. The oil circuit-breakers will be Type JB 441 having all three phases in one tank. This will be the first installation in this country of a 132 kV circuit-breaker of this type. Many installations are also in hand both for this country and abroad. Air-blast 132 kV 2,500 MVA gear is on order for the extensions at Brunswick Wharf, and for Andover substation.

More than seventy Metropolitan-Vickers air-blast circuit-breakers of the 220/300 kV range are now in service or on order. The GA10W8 air-blast breaker has been further developed for the Staythorpe station of the B.E.A. on the 275 kV grid, and similar breakers are in hand for the switching station at Carrington. Oil circuit-breakers rated at 8,500 MVA, 132 kV are in hand for an extension

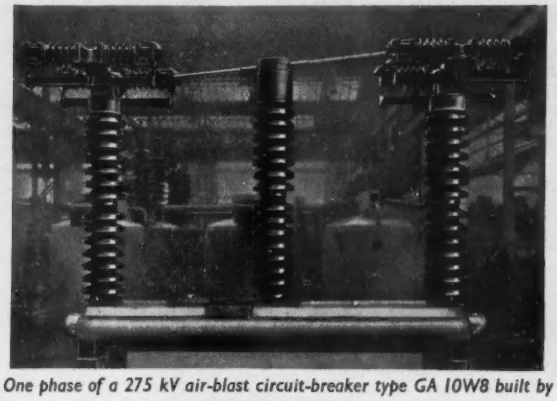
to Clyde's Mill station in South West Scotland. These have eight breaks per phase with non-linear resistance switching and compressed-air closing.

All companies are heavily employed in the manufacture of switchgear for lower ratings and voltages.

Industrial Machines

The range of industrial machines and plant is so great that space only permits a fleeting reference to some of the larger or more unusual orders. Heavy motors for rolling mills continued in demand and a noteworthy continental order for d.c. main motors each of 6,700 h.p. (emergency peak 21,100 h.p.) together with the d.c. generators was fulfilled by Metropolitan-Vickers. Several other orders both for home and abroad are in hand. The company is also supplying large numbers of smaller motors for domestic and industrial use.

English Electric have received orders for drives for high-speed sectional paper mills, incorporating electronic control of the d.c. driving motors for ensuring accurate speed matching between the mill sections, and six a.c./d.c. motor generator sets, each consisting of four 1,500 amp generators



One phase of a 275 kV air-blast circuit-breaker type GA 10W8 built by Metropolitan-Vickers

and a driving motor, are on order for a plant which will produce sponge titanium in large quantities. Again fractional h.p. motors have continued in great demand for domestic appliances, machine tool drives and textile mills.

Many motors are being supplied by G.E.C., new developments of the Steel Co. of Wales for example require a further 114 mill type motors, totalling over 7,500 h.p. The Shell Petroleum Co. has ordered 250 motors for driving oil well pumps and these machines have been supplied with fully automatic control gear.

Rolling mills also took a proportion of the B.T.H. output. The modernisation scheme at Round Oak Steel Works, Brierley Hill, Staffs, called for one reversing cogging mill equipment with a 4,000 h.p. (cut-out 12,000 h.p.) d.c. motor, and two further motors with similar output for a reversing section mill, and a reversing billet mill. For the Velindre Plant of the Steel Co. of Wales, B.T.H. are supplying the electrical equipment for a 5-stand tandem mill, requiring one 1,750 h.p., two 3,500 h.p., one 4,000 h.p., one 5,500 h.p. and one 900 h.p. d.c. motors. All will be supplied with power from two synchronous motor-generator sets.

Rectifiers

G.E.C. have supplied a number of single-anode pumpless steel tank rectifiers for Wilton-James printing press drives for home and overseas newspapers. Traction, however, continues to provide the major demand for rectifiers and many units are being made for rail electrification schemes at home and in countries abroad. Bruce Peebles report that work is nearing completion on the contract for the manufacture supply and erection of nineteen 2,500 kW, 1,500 volt d.c. substation equipments for the Manchester-Sheffield-Wath scheme.

Among the rectifier equipments on order from B.T.H. is one for I.C.I. which covers ten contact rectifiers, each rated 3,300/4,050 kW, 220/270 volts, 15,000 amperes. This contract is of interest as this type of rectifier has not previously been manufactured in Europe.

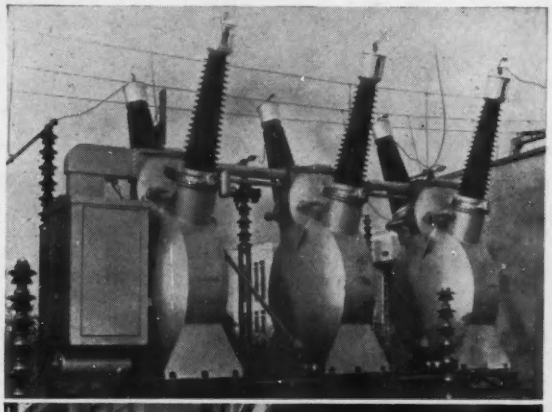
A 1,200 kW 630 V rectifier unit has also been supplied for a traction substation on the London Transport Executive system at Whitechapel. This unit has been built to occupy the minimum of space and the rectifier cubicles stand right up against the transformer with flexible interconnections. The unit occupies a floor area of only 10 ft 3 in. by 10 ft 10½ in. and an output of over 10 kW per sq ft has thus been achieved. The transformer is of the dry type, hermetically sealed, and uses a closed air-circuit system.

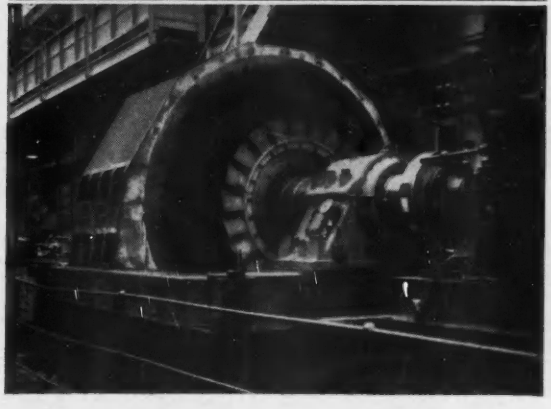
Two 1,650 kW mercury-arc rectifiers were installed by English Electric during the year, to provide power for the main motors of the new rod mill at Warrington Works of the Lancashire Steel Corporation, and another noteworthy installation was of two 4,200 kW sets feeding d.c. motors in the test plant of the Bristol Aeroplane Co. In addition several sealed steel-tank units were supplied or are on order for rail electrification schemes.

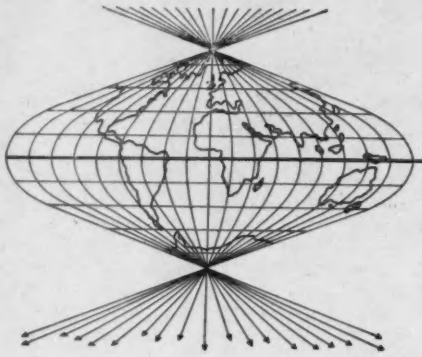
(*To be continued*)

Top : B.T.H. Type JW419 Shuntarc oil circuit-breaker undergoing 220 kV line dropping tests at Electricite de France's Fontenay Testing Station

Bottom : A 14,000 kVA hydro-electric generator in course of erection for works tests. This is one of two built by Bruce Peebles to Norwegian order







OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Bersimis Contract

The English Electric Co. of Canada has been awarded a $1,800,000 contract for the supply of four 150,000 h.p. hydraulic turbines for the Bersimis power project of the Quebec Hydro-Electric Commission. A further four turbines are to be added later, we understand. The first sets are to be in operation by Dec. 1956, for the Commission recently signed a contract to supply 80,000 h.p. from the plant to the Shawinigan Water and Power Co. at that date. Ultimate capacity of the project has been put at about 2,000,000 h.p. The site of the Bersimis development, on which construction has started is about 90 miles above the confluence of the Bersimis River with the St. Lawrence, and about 200 miles north east of Quebec. An essential part of the project is the construction of a proposed 300 kV transmission line linking the power station with Quebec.

N. B. Plans

The preliminary work for the Beechwood power project on the St John River is well under way by engineers of the New Brunswick Electric Power Commission, Mr C. H. Forbes, the commission's vice-chairman, has stated. When their work is completed, an outside firm of consulting engineers will have to be called in for the actual designing of the plant if the government decides to go ahead with the plan, he said. The Commission estimates it would be able to generate 90,000 h.p. at Beechwood.

Commission's Outlay

The new Niagara power development of the Hydro Electric Power Commission of Ontario will go into operation on 30 Aug. next, right on schedule. Mr R. H. Saunders, chairman of the Commission has stated. He was addressing delegates at a district meeting of the Ontario Municipal Electric Association. Refering to the frequency standardisation scheme, he said that expenditure up to the end of 1953 was $160 millions. When the programme was fixed in 1948 there were 784,000 consumers. Today there were 904,000 consumers and when the programme was initiated it was estimated there would be an average of 2·7 pieces of frequency sensitive equipment per consumer. Today there were four, making a further 1,293,000 appliances requiring conversion. Regarding the power supply situation, he said they did not know what they would have done during the past few months without the Windsor and Toronto steam generating stations.

Columbia River Development

The Consolidated Mining and Smelting Co., and the West Kootenay Power and Light Co. have been invited to each send a representative to sit on a committee attempting to draft a hydro-electric development policy for the Columbia River Basin. The committee is to meet again on Monday next. Mr R. E. Sommers, British Columbia Minister for Lands and Forests, has said that the Province's policy regarding the development of the river's resources could not be determined until the four north-western States had worked out their plans. Any major development of the Columbia River or its branches in Canada or the U.S. would have repercussions on the other side of the border. The four States and B.C. face the immense task of working out a plan for payment of costs and the division of the power.

BRAZIL

Funds for Development

A loan of 171,798,000 cruzeiros, granted by the National Bank of Economic Development to the State of Espirito Santo, Brazil, will be employed by the State in the construction of the Rio Bonito hydro-electric power plant. The construction of that project falls within a programme covering the erection of four plants which together will be able to generate about 237,800 h.p. The plants are to be constructed in the valley of the Santa Maria river and will provide power for an area of 11,300 sq km. The dam for the Rio Bonito plant is already half finished and will finally be 260 metres long. A fall of 140 metres is to be utilised. Three turbines, with a total output of 24,000 h.p. are being installed. German material is being employed at the plant, which should be in operation by next Jan.

EUROPE

W. German Production

The West German electrical industry produced goods worth 6,750 million D-marks in 1953, an increase of about 650 million marks over the figure for 1952, according to reports. A rise in output of consumer goods, especially electrical household appliances and small electrical equipment, was mainly responsible for the higher total, it is stated. Production of refrigerators reached a value of 200 million marks. Among investment goods, the main increases were recorded for electric vehicles and transformers, while output of motors, generators, accumulators and low-voltage switchgear declined slightly. Exports of electrical equipment amounted to some 1,250 million marks in 1953, against 1,046 million in 1952. This result had been achieved in spite of declining world market prices and strong foreign competition. Production this year is expected to remain steady. The industry is now in a position to supply complete electrical equipment for 75 electric locomotives each year, to aid the continued electrification of the railways.

Poland's Railways

It is now expected that electric trains will be running on the Warsaw-Lodz line before the end of this year. The electrification of this line is an important stage in the complete electrification of the Warsaw-Czestochowa-Stalinogrod line, with a branch line to Lodz, envisaged in the Six-Year Plan. This is the busiest line in Poland and the introduction of electric trains will mean a considerable shortening of schedules. Work is now concentrated on the Skierniewice (Warsaw Voivodship) — Koluszki (Lodz Voivodship) section, which will be finished by May this year.

Gibraltar's Conversion

The changeover of the Gibraltar City Council's electricity distribution system, and the extension to the power station, has been completed. Planned in 1946, the changeover work has involved the conversion of the old 110/240 V 76 cycles system to a modern 240 V a.c. 50 cycle network. In addition, a further 800 kW diesel generator has just been

installed raising the capacity of the King's Bastion power station to 4,950 kW. The completion of the scheme was the occasion of a formal visit to the works at King's Bastion by city councillors and heads of departments recently, when the city electrical engineer, Mr E. V. Andlaw, M.B.E., A.M.I.E.E., A.M.I.MECH.E., and his staff were congratulated on the efficiency of the Department. It was stated that consumers' apparatus involved in the change-over work included 4,654 electric irons, 1,405 radiators, 3,397 radio sets, 73,100 light bulbs and 13,348 chandeliers and portable lamps.

MIDDLE EAST

Plan for Crete

The Greek Government Co-ordinating Council has decided to call for Greek and foreign tenders for the drawing up of a final and balanced survey for the construction of hydro-electric projects throughout Crete. The Council has further decided to establish in the Island a 15,000 kW plant from German reparations. Expert technicians have been invited from Germany to make a survey for the establishment of this plant.

AFRICA

Salisbury's Expansion

For the erection of the second stage of the Council's No. 3 power station, the Salisbury City Council, Southern Rhodesia, has applied for consent to borrow the sum of £1,541,000. Work on the first stage of this new station began last year. It is to be of the semi-outdoor type, an arrangement which Mr J. E. Mitchell, the city electrical engineer, considers will result in saving the Council over £100,000. The first stage of the station is planned to be in operation by 1956-57.

Abidjan Project

After a further period of experimental work, plans are now ready to proceed with the construction of a power generating plant at Abidjan, on the Ivory Coast, French West Africa, to utilise the thermal energy of the sea. The scheme, to which we have previously referred, provides for the installation of two 3,500 kW generators. Cost of the scheme is put at just over 500 million francs and when these funds are available a start will be made. The project is being carried out by the Societe Energie des Mers, a state controlled concern which was set up for the purpose of instigating a power scheme at the site. At Abidjan, water taken from the lagoon is 82° F. — 36° higher than the offshore 13,000 ft below the surface. The plan is to bring the two waters together, using an articulated pipe 2¾ miles long and 8 ft dia. The plant's thermodynamic cycle will begin when part of the water drawn from the lagoon is evaporated under vacuum, providing steam to drive the turbines. One of the primary difficulties, that of evaporating water at relatively low temperatures, has been overcome by Prof L. Nisolle with an experimental evaporation and de-gassing apparatus. In the plant everything but the generator itself will operate inside a vacuum shell made of reinforced concrete, with a special plastic coating. Officials in charge of recent experiments point out that the plant could provide cheap supplies of distilled water, salt and other sea water derivatives.

INDIA

Consultants Needed

The urgent need for the establishment of a cadre of consulting engineers was stressed by Mr K. B. Carnac, chairman-elect of the Institution of Engineers (India), Bombay Centre, recently. He attributed the reason for the lack of interest in the profession of consulting engineers to the slow rate of progress in the industrial and technological sphere in the pre-war period. With the advent of political independence, a number of heavy engineering projects had been taken up for execution and more were under consideration. Conditions were, therefore, favourable for the development of the consulting engineers' profession, he added.

Bombay Project

Preliminary work on the Koyana Project in Bombay State was inaugurated recently by the Chief Minister, Mr Morarji Desai. The first stage of the project, which forms part of the Five-Year Plan, will be completed at an estimated cost of Rs. 330 million. It is proposed to build a 204 ft high dam to store over 36 million cubic ft of water; 240,000 kW of power will be generated, a large bulk of which will be supplied to the Bombay/Poona area. The water will be carried to power units through a tunnel across the Western Ghats.

MALAYA

Air Coolers Wanted

Further to our note last week concerning the development in Malaya, it has been reported that there is a steady demand throughout Malaya for large air-conditioning plants and domestic units. Apparently this demand is being satisfied almost entirely by American firms. The report states that British manufacturers have not yet put on the market in Malaya small room-coolers which are competitive with American units, although it is understood that these are expected to make their appearance soon. British firms have been more active in quoting for large installations, but in spite of their prices being competitive, have not obtained much business yet, it is stated.

AUSTRALIA

More Power for Victoria

The first of three 10,000 kW generators at the new power station at North Geelong, has been put into operation by the State Electricity Commission of Victoria. Two further sets of similar capacity are to be installed within the next two or three months.

A Film Show

As an aid to further its rural electrification scheme, the Electricity Authority of New South Wales is this month releasing a colour documentary film which has been made under a Belgian process. The film illustrates the way in which electricity has already been extended to many farms, villages and towns, but it shows too, numerous examples of how electricity can greatly aid farmers, more particularly in its many applications outside the farmhouse.

Construction of the Forcacava hydro-electric station of the Brazilian Traction Light and Power Co., Ltd., at Fontes, is now well under way. Our illustration shows the first sets being installed in the underground station. Ultimate capacity of the project is to be 330 MW. This scheme has been made possible by the diversion of the Paraiba-Pirai Rivers. In this some 5,650 cusecs of water taken from the Paraiba River is pumped up into a basin known as the Santa Cecilia reservoir which has been formed by damming the river. It is later joined by water from the Pirai River, and pumped into the Vigario reservoir. In these two pumping stages the water is raised 148ft. and conveyed 20 miles to the valve chamber at Fontes feeding the power station. The five pumps at Vigario will be able to operate in reverse as generators to carry system peaks up to 50 MW

Personalities

IN THE INDUSTRY

Arrow Electric Switches Ltd. announce that **Mr B. C. Skinner,** general sales manager, has been appointed a director of the company and is undertaking a world tour immediately. He leaves by air today, the 18th, for the United States where he will spend six days with Arrow's parent company in Hartford, Conn. His next call will be at San Francisco, and thence via Fiji to New Zealand and Australia where a new sales promotion programme is being inaugurated. Mr Skinner will return via Malaya and India, arriving back in this country in early April.

Mr J. Wilson, now foreman electrician with Oldham Corporation Passenger Transport Department, Electrical Section, has been appointed electrical superintendent to Southdown Motor Services Ltd. He will have charge of the electrical equipment in that firm's many buses and coaches and in their various depots.

For the position of purchasing officer to the North Western Electricity Board, **Mr E. F. Westwood,** M.ENG., M.I.E.E., has been selected. He is at present mains engineer to the Board's No. 6 (Lakeland) sub-area, and his new appointment takes effect from 1 Mar. As purchasing officer, he succeeds **Mr Frank Linley** who, as we have already noted, has been appointed manager of the Board's No. 1 sub-area. Born at Barrow, Mr Westwood was educated at Barrow Grammar School and Liverpool University. In 1927 he joined the Barrow Corporation Electricity Department, he became senior technical assistant to the Mid-Southern Utility Co. at Aldershot in 1935. Five years later he was appointed engineer and manager of the Morecambe and Heysham Corporation electricity undertaking, holding that position till nationalisation of the Industry when he became assistant planning engineer to the Board's Lakeland sub-area where he was appointed mains engineer the following year.

Due to arrive in the U.K. today for training provided by H.M. Government under the Colombo Plan Technical Co-operation Scheme, is **Mr Shah Muhammad Al-Hussainy,** executive engineer in charge of construction of a diesel power station at Dacca, East Pakistan. He will spend six months with John Thompson Water Tube Boilers Ltd., of Wolverhampton; six months with A. Reyrolle and Co., Ltd., of Hebburn; and nine to twelve months with the B.E.A., studying electrical engineering and gaining experience in the operation of turbines in thermal power stations, the erection and maintenance of transmission lines, and administration matters. Earlier this week **Mr S. P. Rajanayagan,** O.B.E., B.SC., A.M.I.E.E., assistant chief telecommunications engineer in the Ceylon Government's Posts and Telecommunications Department, arrived in this country for study under the scheme. He is to take a three months' course in telecommunication engineering with the Post Office Engineering Department.

Mr C. W. Goodman, of the English Electric Co., Ltd., Sydney, New South Wales, has been appointed president of the Australian Association of British Manufacturers.

Mr J. N. Dean, B.SC., F.I.R.I., A.I.C., previously managing director, has been appointed deputy chairman of the Telegraph Construction and Maintenance Co., Ltd. The executive duties of the Board will no longer be vested in a managing director but will be carried out by a managing board, of which Mr Dean, as chief executive, will be chairman. Mr Dean is also managing director of Submarine Cables Ltd., chairman of Telcon Telecommunications Ltd. and of the Selborne Plantation Co., and a director of Johnson and Phillips Ltd.

Mr S. J. Emerson, M.ENG., A.M.I.E.E., has been appointed deputy electrical inspector to the Factory Department of the Ministry of Labour and National Service. He succeeds **Mr F. H. Mann,** M.I.E.E., who, as we have already noted, is now the senior electrical inspector following the recent retirement of **Mr H. W. Swann,** O.B.E., M.I.E.E. Mr Emerson was educated at Wirral House School, Chester, Liverpool University, and the School of Military Engineering. He served a pupilage with Sandycroft Ltd., mining, mechanical and electrical engineers, and was distribution and transmission engineer with the Mersey Power Co., Ltd. before joining the Home Office in 1931. During the last war, in which he served with the R.E.'s for 6½ years, he was for some time deputy chief engineer with S.E.A.C., chief engineer of an airfield development group and, for a period, director of machinery, India Command.

Mr A. R. Taylor, A.M.INST.C.E., A.M.I.STRUCT.E., has been appointed to succeed **Mr A. E. Brook,** A.M.I.STRUCT.E., senior assistant engineer (civil) in the generation construction department at Sheffield, of the Yorkshire Division, B.E.A. Mr Taylor was educated at Manchester Grammar School and Salford Technical College, and served an apprenticeship with Edward Wood and Co., Ltd. After war service he was assistant civil engineer with C. S. Allott and Son, consultants, of Manchester, from 1947-1950, during which period he worked on the Westwood power station project among others. From 1950 to 1952 he was 3rd assistant in the Merseyside and North Wales Division of the B.E.A. under Mr W. H. C. Pilling, and since that time up till the present he has been 2nd assistant in the East Midlands Division, being chiefly concerned with the Spondon and Northampton power station projects.

From Marryat and Scott Ltd. we learn that **Mr Murray D. Scott** has retired from active management of the company after 34 years, but remains as chairman of the company (Mr and Mrs Scott are at present on holiday in the Caribbean). In consequence, **Mr L. W. Honey,** ASSOC.M.E.E., and **Mr L. J. Gooch,** A.M.I.E.E., have been appointed joint managing directors of the company. Mr Honey, who will operate from Hounslow Works, joined the firm in 1918 and was appointed to the Board in 1940. He was

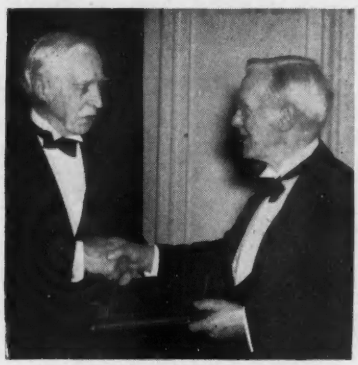
Mr B. C. Skinner

Mr J. N. Dean

Mr E. F. Westwood

largely responsible for the present standardisation policy, and is the author of "Lifts," the book published by Marryat and Scott. Mr Gooch, who will operate from the London office at 40 Hatton Garden, E.C.1, was apprenticed to the late Howard Marryat in 1914, and joined Marryat and Scott Ltd. in 1923, becoming a director in 1940. He is the author of "Electric Lifts" (Pitman) and recently visited South Africa in connection with the installation of the firm's lifts there.

To mark his retirement from the position of head of the B.E.A.M.A. Steam Turbine and Allied Plant Sections after 35 years' service, **Mr I. V. Robinson,** WH.SC., M.INST.C.E., M.I.MECH.E., recently received a presentation from representatives of those sections at a dinner at Connaught Rooms, London. The presentation, which was made by **Lt.-Col Morcom,** C.B.E., T.D., comprised an inscribed gold watch and an illuminated album containing signatures of Mr Robinson's many friends in the Industry. Mr Robinson's work in respect of steam



Mr I. V. Robinson (right) receiving the presentation from Lt.-Col Morcom

turbine and allied plant is being taken over by **Mr G. T. H. Spurling** who was appointed his chief assistant about a year ago. Mr Robinson will, however, be continuing many of the other activities with which he has been associated.

At the request of the Government, the British Electricity Authority has agreed to the secondment of their commercial manager, **Mr E. R. Wilkinson,** M.I.E.E., M.I.MECH.E., to assist the International Bank for Reconstruction and Development in the technical and economic appraisal of certain international electrical power developments. He is leaving this country on Saturday next, and has been particularly assigned to study economic electrical development in Mexico, we understand.

The Edison Swan Electric Co., Ltd., announce that **Mr J. Petrie** has been appointed manager of their Nottingham district office. He has for 23 years been attached to the Dundee district office, rising to the position of senior representative.

Mr J. Petrie

Mr L. C. Rettig

Mr H. Moss

To many of our readers in the electrical contracting and lighting industries, **Mr Harry Moss,** M.I.E.E., F.I.E.S., needs no introduction—he is still very active although in his 75th year. As many will know he is a frequent contributor to the Press, too, and it seems that this activity on his part goes back to 1898—quite a unique record. A strong believer in the electrical way of life, Mr Moss can usually be relied upon to provide a ready answer in the correspondence pages of the lay press to any derogatory remarks concerning electrical matters. May his pen long continue to write.

Previously with the Lighting Service Bureau, **Mr L. C. Rettig,** F.I.E.S., has joined the Commercial Engineering Department of Siemens Electric Lamps and Supplies Ltd., as lighting engineer for Scotland, and will be based at their Glasgow branch. Mr Rettig, who has been a vice-president of the Illuminating Engineering Society, was earlier with R. W. Gregory and Partners before joining the Lighting Service Bureau.

Mr B. J. Algar has been appointed a director of General Engineering Co. (Radcliffe) Ltd.

Mr E. J. Davies, of Wandsworth Electrical Manufacturing Co., Ltd., and **Mr P. E. Wheatland,** of General Electric Co., Ltd., have been elected chairman and vice-chairman respectively of the Association of Maunfacturers of Electric Wiring Accessories. They have both also been appointed the association's representatives on the Electrical Fair Trading Council.

On Friday last, **Mr C. A. Cameron Brown,** agricultural electrification adviser to the B.E.A., left this country for Turkey where he will join experts from Sweden, Belgium and France, as members of a United Nations Mission to advise Turkey on the development of rural electrification. The mission is being organised and directed by **Mr Sevette,** chief of the Electric Power Section of the U.N.E.C.E.

At the annual general meeting of the Association of Manufacturers of Small Switch and Fuse Gear, **Mr R. Nicholls** (Wm. Sanders and Co. (Wednesbury) Ltd.) and **Mr B. W. Pickup** (Falk, Stadelmann and Co., Ltd.) were re-elected chairman and vice-chairman respectively of the Association. They also continue to be the Association's representatives on the Electrical Fair Trading Council.

OBITUARY

Mr J. Hyde, partner in the Yeovil electrical and general engineering firm of Hyde and Wakely, has died.

Mr W. E. Maddock, formerly secretary of the Uxbridge and District Electric Supply Co., Ltd., died on 9 Feb., aged 66.

Mr W. A. Tookey, M.INST.C.E., M.I.MECH.E., for many years a consulting engineer, died on 9 Feb., aged 82. He specialised in matters relating to power-house machinery and power transmission, more particularly with regard to internal combustion engineers.

Mr J. Lewis, who retired from the position of joint general manager of the Marconi International Marine Co., Ltd., in 1948, died on 9 Feb., aged 69. He started with the Marconi Marine Co. as a sea-going wireless operator, and after holding various positions, became assistant general manager in 1928. He played an important part in the introduction of the echo-meter by the Marconi Co. and became joint general manager of the Marconi Sounding Device Co., Ltd. in 1931. His appointment as sole general manager of that company followed in 1933 and he was later made a member of the board of directors. He was appointed joint general manager of the Marconi International Marine Communication Co., Ltd. in 1935 and in 1937 was transferred to Marconi's Wireless Telegraph Co., Ltd. as assistant to the managing director. Later he again became joint general manager of the Marine Co., which position he held until his retirement in June 1948. He had since been retained as a consultant.

Mr J. W. Stevens, London director of the Express Lift Co., Ltd., of which he was a co-founder, died on 9 Feb., aged 67. He acted as managing director from 1923 to 1936, after which he continued as a director and sales manager until retiring in July 1953.

Mr R. J. Plummer, chairman and managing director of Ceag Ltd., died on 14 Feb. aged 72.

Maj E. H. Armstrong, Professor of Electrical Engineering at Columbia University, died on 1 Feb., aged 63. He was associated with a number of radio developments, including the feed back circuit, the introduction of the superbeterodyne receiver, and the frequency modulation system.

NEW LITERATURE

Mechanical World Electrical Year Book 1954

ONCE again this useful little publication makes its appearance, new sections and revision throughout maintaining its topicality. Newcomers to this year's volume are sections on automobile electrical equipment and safety precautions in the use of machine tools. The former is particularly useful, dealing comprehensively with the various systems, machines and types of apparatus now in use. There is the usual general revision of the text, particularly the note on installation tests, earth-leakage trips and the table of horse-power required to drive machinery. For the wireman or maintenance electrician this comprehensive volume should be a standard reference book, and both its size and price suit the pocket. Published by Emmott and Co., 31 King St West, Manchester 3, 357 pages, 6 in. by 4 in. Price 3s.

Mechanical World Year Book 1954

NO less useful to the electrician is this companion volume to that reviewed above. The 1954 volume has two particularly important additions, the first being "A review of progress in the steam cycle and the performance of steam Turbine Plants" by J. R. Finniecome. Particularly appropriate to the time, this section provides a picture and much useful data of outstanding developments of the present time. The other new section, contributed by H. Silman, is devoted to metal finishing, an important subject when so much consideration has necessarily to be given to the protection and final appearance of metal products in both production engineering and consumer economy. Detail revision of the text is to be seen as usual, the volume being an ever useful compendium of facts and figures and practice well worth the money asked for it. Published by Emmott and Co., 360 pages, 6 in. by 4 in. Price 3s. 6d.

Further Advice on Stage Lighting

by Strand Electric & Engineering Co., Ltd.

THE importance of good stage lighting can hardly be over-estimated, yet all too often in amateur dramatics, the lighting is regarded almost of secondary importance. This little book, prepared by the Amateur Advice Section of the Strand Electric and Engineering Co., is specially written for the guidance of producers and lighting technicians. It was originally issued five years ago under the title of "Some Advice on Stage Lighting," and as the demand was so great, this, the third reprint, has been extended to give further detailed information on the choice, erection and adjustment of lanterns, and has also new tables showing the beam angles and relative intensities of the new standard stage lanterns. With the tremendous knowledge of stage lighting possessed by the Company, even the more experienced of stage-lighting technicians in the amateur world cannot fail to benefit by the sound advice given in this excellent little book. Obtainable from the Strand Electric and Engineering Co., Ltd., 29 King Street, W.C.2, 90 pages, 8½ in. by 5½ in. Price 2s. 6d.

Electrical Trades Directory

IN support of its claim to be the most comprehensive directory of its type in the industry, this 1954 edition has been further enlarged by the inclusion of additional references. As before, the largest portion of the volume is devoted to a classified list of suppliers of various products and materials, and it is here that much of the expansion has taken place. The Trade Names section has also been enlarged. As in former editions there are alphabetical lists of manufacturers, merchants, contractors, wholesalers, and various classes of engineers, followed by a personal section, making it an invaluable work of reference. Published by Benn Brothers Ltd. 1,539 pages, 9 in. by 6 in., price £2. 10s.

Mechanical Vibration

by G. W. van Santen

THE full title of this book is "An introduction to the study of mechanical vibration," but this volume is more than just an introductory survey. Most of its text is, admittedly, concerned with fundamental theory of mechanical vibration, and this is dealt with exhaustively in a manner which is both erudite and clear. Where the book is particularly valuable, however, is in the practical problems considered, both as sources and measurement of vibration. Whereas the work in particular has a definite appeal to the student and research technologist, its associations with practice in electrical as well as mechanical fields, deem it worthy of a place on the engineer's book shelf.

Its beginning is with elementals, introducing vibration by discussing its nature, representation and analysis. Damped and undamped free vibrations are then considered in greater detail from this basis as are forced vibrations. The next section amplifies the subject, considering vibrations in more than one direction, whilst the value of analogies is discussed. Isolation of vibration, resonance curves and propagation of vibrations are duly considered with characteristic thoroughness. Sound and other wave phenomena are also discussed fully. Practical implications in shafts receive special attention, leading on to a consideration of balancing, whilst methods of damping are also discussed. Next to receive attention are special vibration phenomena, and the detrimental effects of vibration, whilst the remaining chapters are concerned with the principles and practical aspects of vibration measurements. Published for Philips Technical Library by Cleaver, Hume, 308 pages, 9 in. by 6 in. Price 30s.

BOOKS RECEIVED

Handbook of the Fan Engineering Industry. A F.M.A. publication surveying the products manufactured by the fan industry. Published by the Fan Manufacturers' Association, 59 High Holborn, W.C.1. 58 pages, 9¾ in. by 8 in. Price 3s. 6d.

Electrical Engineering for Mining Students, by G. M. Harvey. Text has been revised and brought into line with modern practice. Published by Pitman, 158 pages, 7½ in. by 4¾ in. Price 15s.

Electric Traction Handbook, by R. Brooks. Presents comprehensive account of control apparatus of electric road and rail traction, for both general engineering and specialist interests. Published by Pitman, 322 pages, 8½ in. by 5½ in. Price 30s.

Introduction to Ultra High-frequency Radio Engineering, by S. A. Knight. Non-mathematical guide to the methods and techniques of modern u.h.f. radio and radar engineering for engineers and students. Published by Pitman, 256 pages, 7½ in. by 4¾ in. Price 21s.

High Voltage Laboratory Technique, by J. D. Craggs and J. M. Meek. Summarises some of the advances made in this field, for graduate engineers and physicists studying the subject. Published by Butterworths, 404 pages, 9¾ in. by 6 in. Price 65s.

The Synchronous Induction Motor, by J. Griffin. Collates wide range of information for both teaching staff and students and engineers. Published by MacDonald, 136 pages, 8½ in. by 5½ in. Price 18s.

Electrical Installation Work, by T. G. Francis. Revised edition referring to the 12th edition of the I.E.E. Regulations, designed primarily for craftsmen and technicians studying the subject in C.G.I. classes. Second edition, published by Longmans, Green, 256 pages, 8½ in. by 5½ in. Price 12s. 6d.

Direct Current Circuits, by E. M. Morecock. First book in electricity prepared for use in American technical institutes and schools and industrial courses, revised to use m.k.s. system. Second edition, published by McGraw-Hill, 388 pages, 9 in. by 6 in. Price 40s.

Elementary Electrical Engineering, by A. E. Clayton and H. J. Shelley. Largely reprint of previous edition, with incorporation of the m.k.s. system of units: Fourth edition, published by Longmans, Green, 490 pages, 7¾ in. by 4¾ in. Price 14s.

Transformer Self-Capacitance

Further report of E.R.A. work in series investigating system restriking voltage characteristics

INVESTIGATIONS of factors affecting restriking voltage characteristics of the 132 kV grid system necessarily involves measurement of the self-capacitances of network elements. Such work, undertaken on a number of high voltage transformers and reactors and other elements is described in a recent E.R.A. report (Ref. G/T272). Although the E.R.A. measurements were made on 132 kV plant, the report also gives available data on the total capacitance to earth of windings of transformers in a voltage range of 11 to 275 kV. This capacitance varies widely among different designs. Hence the data does not allow a representative value or curve relating restriking voltage to transformer MVA capacity to be estimated.

Two methods of measurement were employed by the E.R.A., the restriking voltage indicator and resonance methods. In the former, a linearly rising current is injected into the circuit, and the resultant transient voltage recorded on a c.r.o. From the frequency of the oscillatory component of this voltage, and the value of the appropriate circuit inductance, the self capacitance is evaluated. The second method consists in supplying the network from a source of variable frequency, which is adjusted until the system resonates. Both methods gave results in good agreement.

Parameters Measured

Four parameters were measured in each case, the first being the effective positive sequence capacitance. Transformer windings were connected in star, with the neutral joint earthed, and the secondary windings short-circuited and earthed. Where bus-bar or bushing capacitances were under test, these were connected to a star of three equal inductances with the neutral point earthed. Measurements were made between one phase and the other two phases joined together, representing the interruption of the first phase to clear in a t.p., s.c. fault. By virtue of the measuring equipment's high impedance to earth, the equivalent short-circuit fault is unearthed; hence only positive and negative sequence parameters are involved. Also measured was the effective zero sequence capacitance, obtained by commoning all three phases, earthing the neutral and measuring between the common phase terminals and earth.

For the third parameter, the total capacitance to earth for each phase, the h.v. neutral was disconnected from earth, the h.v. windings short circuited and connected to one end of a coil of known characteristic, whilst the l.v. windings were short-circuited and earthed. After earthing the other end of the coil, its change in resonant frequency due to the added capacitance measured from which a value for this capacitance could be deduced. As this value applies to all three phases, a third of it is the total capacitance to earth for any one phase. Finally the damping characteristics of transformers and reactors was obtained directly from r.v.i. records.

In its conclusions, the report states the effective self-capacitance (which determines the natural frequency of oscillation when the short-circuited transformer is subjected to a current linearly rising from zero) appears to have a minimum value almost independent of transformer size. Rather a minimum figure for all sizes in the range tested (37·5 to 75 MVA), having a value of some 1,000 micro-microforad/phase for both positive and zero phase sequence energisation, is suggested by the results. The value of this capacitance, is moreover, not necessarily related to that between one winding and the other winding earthed to core and tank, the latter varying widely with transformer designs. Tappings, and the other departures from regularity in the windings cause uneven distribution of capacitance which can make it impossible to represent a transformer by a single oscillatory circuit. Moreover, the natural frequency of a transformer is not necessarily the same for all tap settings. It appears that the lowest voltage setting, which covers only the untapped section of the winding, has the highest frequency. In the damping effect, the effective characteristics are difficult of simple expression particularly where component frequencies of multi-frequency transients are taken into account.

BRITISH STANDARDS

Amendment No. 1 to B.S.7:1953 "Rubber-insulated cables and flexible cords." *P.D.1782: 18 Dec., 1953. Gratis.* The major feature of this amendment, which comes rapidly after last year's issue of a revised B.S.7, is extensions made to the scope of the tables specifying thickness of insulation and nominal overall diameter for 250 volt (to earth) cables and medium voltage heavy duty cables. These are tables 22 and 24. The former now applies to single core, flat twin, and circular twin and three-core vulcanised rubber-insulated, taped, braided and compounded cables, whereas it applied only to single-core cables. In the latter case the tables now refer to single core and circular twin and three-core cables instead of single-core cable.

Amendment No. 1 to B.S.546: 1950 "two-pole and earthing-pin plugs, socket-outlets and socket-outlet adaptors." *P.D.1752: 17 Dec., 1953. Price 1s.* Various changes are made to the original standard by the publication of this amendment, one of the chief being the clause referring to the separation of terminals and conductors. A new sentence has been added which requires that when the plug has been correctly wired and assembled, the barriers shall be such that there is negligible risk that a fire or strand that may become loose shall touch other parts with which contact may be dangerous. The other major change is seen in the "go" gauges for plugs and socket-outlets.

Balata belting. *B.S. 2066:1953. Price 2s. 6d. net.* Specified in this new publication, which was prepared to provide a satisfactory standard for balata belting used for power transmission and other load bearing applications, are details of fabric, impregnation, and balata content and quality, among others. Details of methods of testing are given in appendices, two of which, in particular, are concerned with recommended working conditions and information accompanying an enquiry or order for this material.

Magnetic tape for sound recording and reproduction for programme interchange. *B.S. 1568:1953. Price 2s. 6d. net.* One of a series dealing with sound recording and reproduction, this standard is a revision of the 1949 edition. It specifies those requirements for recording on magnetic tape and of associated recording and reproducing equipment which are essential for the successful interchange of recordings. One of its new features lies in the specification of dimensions to allow machine fitments to accept the hubs adopted by the National Association of Radio and Television Broadcasters of America (N.A.B.).

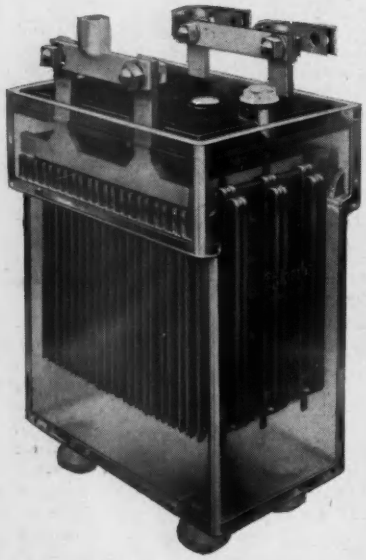
Packaging code: Use of desiccants in packaging. *B.S. 1133: Section 19:1953. Price 3s. net.* Preventing deterioration in the contents of packages, especially those to be exported, can be achieved, in certain cases, by protective treatment of the goods themselves. Where instruments, for example, are to be shipped, such treatment may not be applied and it then becomes essential that they are surrounded by an atmosphere of relatively constant humidity, by the use of desiccated packages. In this section of the Packaging Code, the method of use, choice, quantity and other factors governing the use of desiccants is discussed.

Equipment for Industry

Chloride Batteries' New Large Cell

WHAT is possibly the largest standard sealed-in cell now available for such duties as emergency lighting and switch closing now augments the range of sealed-in stationary cells produced by CHLORIDE BATTERIES LTD., Clifton Junction, Swinton, Manchester. Designated the "Chloride GCG10E," this cell has a stated capacity of 450 Ah at the 10 hr discharge rate down to a final terminal potential of 1·85 V. It may be used for operation on either "floating," trickle charge or straight charge and discharge types of circuit.

Assembled in glass tanks having moulded shoulders to support the plates, and integrally moulded feet, the units are designed for mounting on single tier stands with plate edges adjacent. With this arrangement inter-cell connections are of minimum length, with consequent benefits of a low value of voltage drop under heavy discharge. Cell lids are of moulded ebonite, each being provided with an internally screwed vent hole to accommodate a baffle-type porcelain vent plug. Sealing is effected with a bituminous compound.



The new Chloride GCG10E lead-acid stationary cell which has a capacity of 450 Ah. Just over 14¼ in. long and 19½ in. high, its base width is 8½ in. and overall width 10 in.

Elements of the cell comprise ten Planté type positive plates and eleven box type negatives, each burned to the appropriate group bar. Two hanging lugs on each plate provide means to suspend the plate from the glass shoulders, whilst lead springs at the end of the elements prevent the plates from splaying. "Porvic," in the form of flat sheets, provides separation between plates. Each sheet is mounted in three slotted dowels of polystyrene, the total assembly being held in position by moulded snugs at the top of the dowels which rest on the positive plates. Intercell connections take the form of lead-plated copper straps fixed to the two negative and two positive terminal risers of each cell by lead-covered nuts and bolts.

"Maxwell" speed indicator

ORIGINALLY developed to give accurate rotation-speed measurement of Whittle jet engines, the "Maxwell" precision speed indicator is now generally available for use where measurements accurate to 0·1% are required. These units are manufactured by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, for a range of speeds from 1,000 r.p.m. up to 48,000 r.p.m. Essentially a frequency meter, the instrument's basic operating principle is that of the Wheatstone bridge. One arm of a conventional Wheatstone bridge circuit is replaced by a high-accuracy type mica capacitor, of nominal value 0·15 microfarads, which is charged and discharged through a rapid-acting relay. The rate of relay operation is governed by the frequency of the e.m.f. generated in an alternator coupled to the machine whose speed is being measured. Circuit components are arranged to ensure the complete charging of the capacitor, even at the highest frequency of 250 c/s. The mean value of the signal passed on to the measuring circuit in any given small period of time is thus proportional to the e.m.f. frequency and hence to speed at which the generator is being driven.

As in a Wheatstone bridge, the detecting/indicating galvanometer reads zero when the bridge arms are balanced, this occurring at a frequency redetermined by values of the bridge components. Instruments are normally provided with four ranges of speeds, each being determined by selection of different values of the bridge's variable resistor arm to give balance at four speeds dividing equally the speed range. At speeds other than balance the galvanometer is deflected in proportion to the difference between the actual speed and the balance speed, full-scale deflection being arranged to correspond to the next "balance" speed.

Normally intended for flush panel mounting, the indicator may however be supported from its base.

Counting Cycles

OF particular value to users of resistance welding plant is a cycle counter recently developed by LANCASHIRE DYNAMO ELECTRONIC PRODUCTS LTD., Rugeley, Staffordshire, which though simple in construction gives reliability in service. For counting two dekatron type tubes are used, giving direct counts up to 99 cycles. To exceed this number visual note may be made of the revolutions made by the "tens" counter.

When used with resistance welders, the instrument may be conveniently connected to the primary winding of the welding transformer, provision being made to cater for 100 to 150 volts if necessary. When used with equipment incorporating weld heat control, the counter is stated to give a satisfactory performance, despite the poor waveform associated with this type of equipment under certain conditions. Two additional terminals enable the unit to count indefinitely whilst a supply is maintained across them, although in this instance cycle indication at supply frequency is given. Resetting to zero is provided, by remote control if required. Readily transportable, the unit is designed to operate from a 110, or 200 to 250 volt supply.

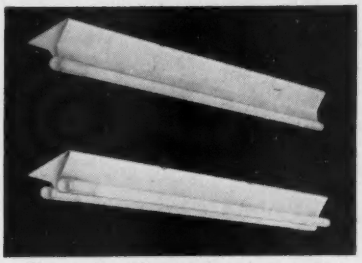
This new cycle counter produced by Lancashire Dynamo Electronic Products can count up to 99 cycles

A.E.G. Motors

DETAILS of part of their range of a.c. and d.c. motors up to 250 h.p. in size are given in a leaflet produced recently by A.E.G. LTD., 131 Victoria St, Westminster, S.W.1. All machines are built in this country to British standards. Single-phase machines are available from ¼ h.p. to 6 h.p. covering a range 100 to 550 V, 40 to 60 c/s and having speeds of 960, 1,440 and 2,800 r.p.m. These units are of the repulsion induction type having high starting torque and stated to be able to withstand short periods of overload without damage. Three-phase units, either of the squirrel cage or wound rotor type range in size from ¼ h.p. to 200 h.p. and are available for the same voltages, frequencies and speeds as the three-phase units. In the d.c. machines are seen compound wound units of up to 70 h.p. for 100 to 600 V and up to 2,900 r.p.m. Also available on request is the company's export list, N.53, giving prices of f.h.p. and three-phase induction motors.

New Atlas "Seagull" Fitting

A NEW conception of the "Seagull" type fitting is the Atlas FX series, which has just been released by THORN ELECTRICAL INDUSTRIES LTD., 105 Judd St, W.C.1. A short ballast tray is provided with four "keyhole" slots for ceiling fixing; these slots are on 24 in. x 2 in. centres, and arrangements for back conduit entry are also provided by two ¾ in. holes at 22 in. centres. The stove enamelled sheet steel reflector is hinged to this ballast tray by a simple device incorporating a quick-release spring clip.



The new Seagull in single and twin types

Thus access to the control gear for connection, adjustment of choke tappings and starter switch replacement is made possible without the use of tools.

The Atlas FX series includes fittings for either one or two 5 ft 80 watt tubes and alternative circuits are available for either switch start or "Quickstart" equipment. In the twin tube version of the fitting, the overall height of the fitting is reduced to only 4½ in.

Non-Corroding Wash Boiler

A NEW wash boiler made by THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is designed to boil 8 lb of linen in 9½ gallons of water. The strong steel outer case has a smooth galvanised finish with an aluminium lid and top which will not rust, while the interior is of tinned copper which will last for years and not stain the clothes being boiled. An automatic cut-out device, supplied with model D.E. 4755, protects both the clothes and the heating elements should the boiler be switched on without water in the container or boil dry.

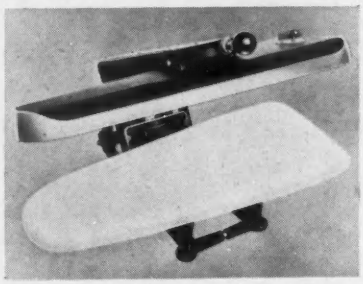
G.E.C.'s new wash boiler

A three-heat switch is provided, giving "full heat" which brings the water to boiling point and ¾ or ½ of full heat, to keep the clothes boiling. A non-splash, chromium-plated tap, which can be fitted with a hose, is provided for draining. The mica-insulated and metal-sheathed heating elements have a total consumption of 3 kW and are for voltage ranges 200/220 V or 230/50 V. The boiler has a diameter 19 in., height 27½ in., weight 32 lb.

The new boiler is available with single pole switches (DE4753) at a price of £8. 19s. 0d.; with double pole switches (DE4754) at a price of £9. 4s. 0d., and with a "Jelson" cut-out (DE4755) for a price of £10.

"Ezy-Press"-ing the Parnall Way

JUST introduced to the Trade by PARNALL (YATE) LTD., of Yate, Bristol, Somerset, the new "Ezy-Press" flat bed ironer is available at a price of £21 plus £7. 17s. 6d.



Parnall's Ezy-Press is simple to operate

It is simple to control with a large ironing surface of 274 sq in. The heating elements, two of 500 watt and one 250 watt are thermostatically controlled through a switch which acts also as on/off switch. Dimensions are 24 in. maximum length, maximum width 11 in., and minimum width 6½ in. (excluding circular end).

Reduction in Porcelain Prices

DRASTIC reductions in prices of semi-recessed porcelain ceiling roses, porcelain cleats, connector blocks and small aerial insulators are announced by METWAY ELECTRICAL INDUSTRIES LTD., King St, Brighton, Sussex, who have listed these prices in a folder just issued, ref. TPS/3.

Lower prices for S.W.S. Washboilers

NEW prices announced by SOUTH WALES SWITCHGEAR LTD., Blackwood, Monmouthshire, for their washboilers are as follows:

Model No.	Price	Model No.	Price
350 S.P.	£9. 5s.	351 D.P.	£11. 9s.
351 S.P.	£11. 3s.	352 D.P.	£12. 12s.
352 S.P.	£12. 6s.	350 J	£10. 10s.
350 D.P.	£9. 11s.	351 J	£12. 8s.
		352 J	£13. 11s.

For the Electrical Trade

Finish and type of these models as follows: 350—Galvanised.
351—Stove Enamel.
352—Stove Enamel with vitreous enamel top cover.
S.P.—Single Pole switching. AC/DC.
D.P.—Double Pole switching. AC/DC.
J—Safety cutout, double pole microgap switching for A.C. only.

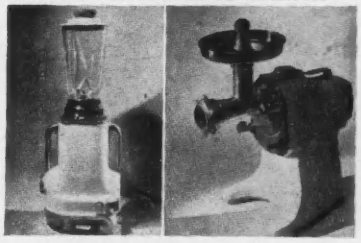
EXTRAS

Hand Agitator Unit—will fit any S.W.S. Washboiler £2. 3s. inc. P.T.
Vitreous Enamelled Top Cover, £1. 3s.
Preserving Basket, 14s. 6d.

"Cresta" Mixing Machines

TWO all-purpose food machines have been introduced in the "Cresta" range by INSULATIONS AND CONSTRUCTIONS LTD., St John's Works, Penn, High Wycombe, Bucks.

They are the "Major" and "Minor" models, the first capable of preparing food for 250 meals and the latter for 25 meals. Both are basically a motor power unit with various attached machines.



The Minor with liquidiser attachment and Major with mincer unit

The motor block of the Major costs £36. 18s. 10d., whilst a complete outfit of mincer, vegetable slicer, whisk, stirrer and bowl, straining machine, discharge chute, coffee grinder, juice extractor, radish and cucumber slicer, chip machine and bean, etc., slicer, noodle attachment, double vibrator, Kosmos almond grinder, potato peeler and liquidiser mixer adds another £119. 6s. 1d. to the selling price. Well worth it when the saving in staff and time is appreciated.

The Minor motor block unit (350 W)

costs £22. 6s. 3d. and has a similar set of attachments.

All the equipment is especially designed for keeping clean, each has three power drive shafts for the various speeds required in differing processes and has as a further attachment an ice cream and freezing attachment.

The "Brent" pig foster mother

NOW in production by the CHURN Co., LTD., Station Rd, Hailsham, Sussex, is a foster-mother for piglets.

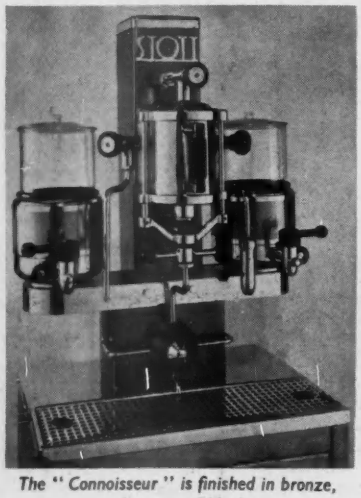
Our photograph shows the No. 1 gravity feed model which is complete with thermostatically controlled 500 W heating element for correct feeding temperature (102° F). It has ten feeding nozzles equipped with rubber teats. Capacity of this model is approximately 2 gals. It is constructed from aluminium with a non-tip weighted base and is listed at £8. 10s.

This "Brent" foster mother has teat accommodation for ten piglets

"Connoisseur" cafe set

THE "Connoisseur" cafe set introduced recently by JAMES STOTT AND CO. (ENGINEERS) LTD., Vernon Works, Oldham, Lancs, has an electrically heated version. Its output is 225 pts of boiling water for tea making or the infusion of 48 pts of black coffee per hour. The beverage is stored in either of the two heated Pyrex glass containers. Hot water is always on tap without noise or excessive steam whilst steam jet heating is available from a swivel injector.

Streamlined in appearance the "Connoisseur" has its central column finished in metallic bronze, the urn platform in chromium and glossy black, whilst other fittings are chromium plated or black plastic.



The "Connoisseur" is finished in bronze, chrome and black

On the electrical specification is the information that the boiler has a normal working pressure of 6½ lb. It is fitted with six 2 kW immersion heaters and one 500 W immersion heater with automatic cutout in the case of low water level. Contactor panel comprises a three-pole air-break contactor to handle 12 kW load balanced over 3 phases. The panel is fitted with three fuses for heater circuits, one for pilot heater and one for pressure control. One pressure control is fitted on panel to break circuit at 6½ lb pressure and to switch in circuit with differential of 1 lb p.s.i. A red pilot light is fitted.

"Nichrome" is a trade mark

CURRENT advertising by BRITISH DRIVER-HARRIS CO., LTD., Gaythorn Mill, Albion St, Manchester 15, is concentrated on emphasising that the word "Nichrome" is their registered trade mark referring only to their products and is not a general term for nickel-chrome alloys.

"Nichrome" nickel and nickel alloys are used in resistance wires in furnace elements and domestic appliances, for thermo-couples, in telecommunications, lamps, spark plugs and for various other fine wires.

TRADE PUBLICATIONS

SOLDERS. Series of booklets recently produced by Grey and Marten Ltd., City Lead Works, Southwark Bridge, S.E.1, describes recommended practice for soft soldering, silver soldering and brazing, amalgam-bearing metals, amalgam fusible alloys, soft soldering of aluminium. Also available are data sheets for different solders and similar alloys produced by the company.

OSCILLOGRAPH. A description of the type o.s.l. 81, 8 record oscillograph (described in our issue of 6 Aug., page 252) is now available from Measurement Ltd., Remote Control Division, Fitzalan St, Kennington, S.E.11.

PUSHBUTTON STATIONS. Under this title, a new publication describing their range of pushbutton units, indicator lamps and pedal switches has recently been issued by the Igranic Electric Co., Ltd., Bedford.

ASBESTOS PRODUCTS. A new descriptive catalogue has been issued by Dick's Asbestos and Insulating Co., Ltd., Thames Rd, Silvertown, E.16.

TELEPHONE SYSTEMS. New publication 1267 is a small leaflet issued by Communication Systems Ltd., Strowger Hse, 8 Arundel St, W.C.2, which describes the firm's internal telephone system products.

MECHANISM CLEANER. A new leaflet has been issued by John Baggs, 45 High St, Uppermill, Oldham, Lancs, which describes the N.S.E. mechanism cleaner. This was noted in our issue 14 Aug., 1952.

FLOODLIGHTING EQUIPMENT. Clarke Chapman and Co., Ltd., Victoria Works, Gateshead on Tyne, have issued a brochure describing football pitch floodlighting equipment which they supply.

SWITCH AND FUSE GEAR. A new section for insertion in the Revo looseleaf binder catalogue, Publication No. 990, has now been issued by Revo Electric Co., Ltd., Tipton, Staffs.

LIGHTING AND LAMPS. New, restyled, attractive catalogue of Mazda lamps has been published by the British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.

MOTORS AND CONTROL GEAR. "Electricity in Industry," issue No. 2, the technical review of the Lancashire Dynamo group of companies, is now available. It contains features on the development of a high voltage laboratory resistance welding control equipments, distributor switchboards and a note about the Golden Jubilee celebration.

TESTING EQUIPMENT. 250 and 500 amp, 1,000 and 2,000 amp and 3,000 amp primary current injection test sets, single phase watt hour meter test sets and a portable h.v. test set are described in new catalogue sheets by Fosters Transformer Ltd., South Wimbledon, S.W.19.

SOOT BLOWERS. The various types of soot blowing equipment are illustrated and described in an attractive brochure just published by the Ivor Power Speciality Co., Ltd., Aberdare, Glamorgan.

GEARING. New publication issued on behalf of The David Brown Corporation (Sales), Ltd., Gear Works Division, Park Works, Huddersfield, covers the full range of D.B. helical units, turbine gear units and flexible and rigid couplings.

CONTEMPORARY LIGHTING. Falk Stadelmann and Co., Ltd., 91, Farringdon Rd, E.C.1, have now published an attractive catalogue No. 800 listing and illustrating their range of contemporary lighting fittings.

ELECTRIC FIRES AND COOKERS. The new season's catalogue issued by Belling and Co., Ltd., Bridge Works, Enfield, Middx., gives in convenient pocket form details of the whole range of Belling fires and cooker.

ELECTRICAL ENGINEERING. The Witton Works of the General Electric Co., Ltd., largest of the firm's manufacturing centres and the application to industry of the plant and equipment produced there is described in a recent brochure issued by General Electric Co.

TRAFFIC SIGNALS. A leaflet issued by the Automatic Telephone and Electric Co., Ltd., Strowger Works, Liverpool 7, describes the Electromatic vehicle actuated traffic signal system and illustrates three important schemes showing the adaptability to particular conditions, of the system.

EMERGENCY LIGHTING. A booklet describing "Nife-Neverfayle" emergency lighting units with steel alkaline batteries has been issued by Nife Batteries, Redditch. Similar new publications by the company deal with maintained and non-maintained and floating emergency lighting units (the latter for use where an automatic switch is not permissible).

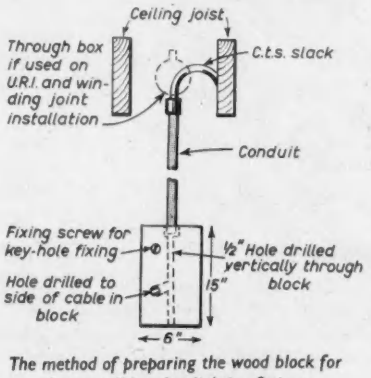
PROBLEMS AND PRACTICE

In Engineering

Wall Bracket Sites

A DIFFICULTY that often arises whilst wiring a house in the carcase stage is how to terminate at a wall bracket lighting fitting point. The large variety of brackets, particularly in hanging and upswept types, prevents the choosing of a height which would suit all requirements. It is seldom that a client can be persuaded to choose the brackets at the wiring stage. Usually, only when the house is completed and furniture moved in, is a variety of brackets delivered and held up for inspection; the final choice often being unsuited to the anticipated height.

To overcome this difficulty, I have found it best to fit at the approximate position of the bracket a timber fixing block about an inch thick, 6 in. wide and 15 in. deep, let into the wall before plastering and decorating. A ¼ in. hole is drilled down through the block. It is better to use, for this operation, an auger, drilling straight through in one operation, rather than a brace and bit, which necessitates drilling half way from each end, and then finding that the two holes have not mated up properly. The conduit and fixing block are then cut into the brickwork, with the cable taken down through the conduit and the ¼ in. hole to the bottom of the block. It is an advantage to drill the first ¾ in. of the block large


Ceiling joist
Through box if used on U.R.I. and winding joint installation
C.t.s. slack
Conduit
Fixing screw for key-hole fixing
Hole drilled to side of cable in block
½" Hole drilled vertically through block
15"
6"

The method of preparing the wood block for fixing wall bracket lighting fittings

enough to accommodate the bushed end of the conduit.

If c.t.s. cable is used a few inches of slack is left above the conduit in the floor space. On a close joint conduit and v.r.i. installation, slack can be left in a through box.

The position of centre of the fixing block is then measured out from the nearest wall, allowing for the thickness of plaster on the completed surface. As a double check to the position of the block, an indelible pencil mark on the floor below the bracket position can be made. After the plasterers and decorators have finished, there is then an unbroken wall surface and when the height of the bracket has been ascertained a hole can be cut into the plaster and fixing block and the cable pulled out for connection to the bracket.

A large number of brackets use the key-hole slot type of fixing but, whether using this sort of fixing block or not, it is an advantage to rise up from the floor below rather than drop from the ceiling above, as the bracket fixing screw comes in the centre of the vertical drop. If it is impracticable to do this, however, when fixing the bracket, a hole can be drilled to the right or the left of the fixing block centre, then dig at an angle into the ¼ in. hole. A screw can then be screwed into the fixing block above the hole drilled into the block.

By experience I have found 6 ft to be a good height for the centre of the block, and a few criss-cross cuts with a saw over the fixing block face aids as key for the plaster. The above method gives a practical variable height 7 in. above or below the centre of the fixing block which I have found satisfactory.—*W. Satchwill.*

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Ceiling Roses

WITH reference to two notes published last year on the removal of stuck porcelain ceiling roses, I have recently had first-hand experience on this subject. The work entailed the re-wiring of over fifty lights in a house, the contract for which stipulated the re-use of ceiling roses, switches and other accessories to keep the estimated price low. Hence the job virtually consisted of only replacing the perished cables.

About 60% of the ceiling roses were stuck tight and would not respond to normal methods. A very effective means of removal was to heat up the ceiling rose with a hand hair-dryer. This tended to soften the paint and a quick twist quite often did the trick. The most effective method, however, was to coat the ceiling rose around the joint with liquid paint stripper. This very soon softened up the paint and made removal quite easy. Only two ceiling roses failed to respond to this treatment.—*"House Electrician."*

System Earth Faults

REFERRING to the note under this heading in the 21 Jan. issue, H. W. R. is considering the best operating condition for his system only if it is accepted that the tripping of switch D is correct. This tripping of D is, however, an incorrect operation of protection because it is the function of protection to disconnect only the faulty feeder. Supplies to consumers were not affected by the tripping of the switch but accepting limitations of switching conditions is no substitute for an investigation into the incorrect operation. The doubts expressed regarding the possible failure of insulation do not appear to be justified as the method of neutral earthing should have been taken into consideration when specifying the cables, transformers and other items.

Sufficient information is not given for a discussion in detail of the protection arrangements or to predict exactly the behaviour of the protection under the particular fault conditions. Some general remarks may be made about the protection and its limitations. If the neutral reactor is tuned the main advantage (of arc suppression coil earthing) is to allow an earth fault to remain on a feeder without the necessity of disconnection. An earth fault relay would only be required in these circumstances to give an alarm to indicate the presence of the earth fault.

As the relay at A would not operate for simple earth faults on the 11 kV system (unless the reactor was of a very low value allowing a large earth fault current which would be cleared by the overcurrent elements of the relay) it would appear that the fault was either a simple phase fault or a two-phase to earth fault. In either case it is probable that the capacitance current would operate the instantaneous earth fault trip coil at D which has a low setting. The solution would be to revise the protection to suit the system. It may also be remarked that the practice of using two pole current relays for star delta transformer protection should be discouraged because a phase fault on the secondary side of the transformer would result in a 2:1:1 current distribution on the primary side and consequently the relay current in one of the three possible faults will only be one half of the value for the other two conditions. The earth fault element in the residual of the overcurrent c.t.'s would in this case provide restricted earth fault protection for the 6·6 kV transformer winding.—*J. Coward.*

NEWS OF THE WEEK

P.T. Statement removes Uncertainty

Retail Trade grateful for Chancellor's Unprecedented Action

SOME degree of stability has returned to the retail trade following the Chancellor's unprecedented announcement regarding purchase tax. The initial disappointment that there are to be no further reductions in the rates of tax "in or before the Budget" appears to have been more than counteracted in many quarters by the compliance with requests from various trade associations, (*a*) that any alterations in the tax be made in January, and (*b*) that it be made known whether those changes were the only ones envisaged or not. The latter comes a fortnight or more late but even that has been overlooked. Mr R. A. Butler, making his statement in the House of Commons, said he had anticipated the Budget because of the large number of representations he had received that uncertainty about the future level of purchase tax was causing interference with normal trade. He said he had carefully reviewed the situation with due consideration to the Exchequer and to individual trades affected. Some concessions had been made in previous Budgets and last month to remedy certain defects, but it had been decided that, subject to any unforeseen developments, no change whatever would be made in the P.T. schedules in or before the Budget.

The Opposition were particularly concerned whether similar action would be taken next year, and whether announcements would be made more with the seasonal moves of the trade. Mr Butler replied that not every trade liked the same month. Purchase Tax could now be varied at any time of the year, he said. He refused to say how the matter would be handled in future but added, "it will be handled to suit the convenience of the industries concerned."

Thus the only safe assumption at the moment is that no further changes will be made in the next two or three months. Alterations later in the year are not precluded, and whether or not a Jan. announcement will be sought next year is a matter to be considered in the future. Meanwhile Mr D. Barber, secretary of the Retail Distributors' Association, prominent among those who made representations last autumn, has said they were extremely grateful to the Chancellor for his statement. The Chancellor had removed current uncertainty and dangers of upsetting spring trade. Much of the problem had been caused by the wrong interpretation of previous statements and the presumption that large-scale cuts in the tax would be made in the coming Budget. This, Mr Barber said, might not recur. In any case further action was not contemplated at present and would only be considered in the light of future events.

British Switchgear for Malta G.C.

AN order for the manufacture and supply of 11 kV 250 MVA rupturing capacity metalclad switchgear to equip 65 Maltese substations has been placed with J. G. Statter and Co., Ltd. The contract was placed by the Government of Malta through the Crown Agents for the Colonies and on the advice of consulting engineers, Preece, Cardew and Rider. Cost will be about £80,000. The substations are part of the electrical development scheme for the island, previously mentioned in our columns from time to time. Early deliveries were required and we understand switchgear for 11 substations have already been despatched.

SPECIAL COURSE ON ELECTRICAL SAFETY

WE hear this week of a special Electrical Safety Course which is to be held at Burton Manor Residential College from 21 to 27 Mar. It is being organised jointly by the College and the Ministry of Labour. In addition to the usual lectures on various problems of electrical safety, such as static electricity, protective systems, the legal aspect of safety, earthing, training of technicians, planning and supervision of work on dangerous and live equipment, a special feature will be the course on the Wednesday on Effects of Electricity on Human Beings and treatment of those effects.

Among the lecturers will be Profs S. Jellinck, Djourno, and Robert Frohlicher, Dr Francois, Dr Fletcher and Dr Hall Ratcliffe. We understand that the chief engineer of the Swiss Inspectorate of Power Installations and representatives of the Inspectorate of Holland, Denmark and France are to attend. Fee for the whole course is £10, including board, and for the day course, £1. 10s.

Turkish Trade Fair

ONCE again the British Chamber of Commerce in Turkey is organising the British Pavilion at the 23rd Izmir International Trade Fair which will take place between 20 Aug. and 20 Sept. The importance of this Fair is increasing annually, attracting some 1¼ million visitors and the patronage of about 15 foreign countries. Last year the British Pavilion was the third largest. Although final charge has not yet been computed, it will probably be about £50 per sq metre of stand space. The Chamber is anxious to make the British Pavilion compare favourably with the stands of other countries.

Enquiries of U.K. firms interested in booking space at the Fair should be addressed to The Auger and Turner Group Ltd., 40 Gerrard St, London, W.1.

Some Moscow Delegates return — Others leave U.K.

MEMBERS of the U.K. Trade delegation which left for Moscow by air towards the end of last month are returning to this country now individually. The leader of the outward-bound party, Mr J. B. Scott, of Crompton Parkinson Ltd., flew into London on Tuesday evening, but this was unfortunately just too late for us to report on as we had already gone to press. At that time there was still no news of any potential or signed electrical contracts. Also arriving back on Tuesday was Mr W. Glass, joint managing director of Johnson and Phillips Ltd., although Mr J. B. McRostie, of the same company is understood to have remained behind in Moscow for further negotiations. Mr McRostie was a member of the delegation's organising committee.

The potential market for electrical equipment which exists in Russia is also being investigated by the representatives of three other firms. At the invitation of the Russian Trade Delegation in this country, representatives of International Combustion Ltd., Aberdare Cables Ltd., and S. Wales Switchgear Ltd., left for Moscow on Tuesday of last week. Mr A. J. Nicholas, director and general manager of S. Wales Switchgear, Mr W. R. Hall, export manager of Aberdare Cables, and two members of International Combustion made up this second party. It will be recalled that following a previous visit to the Russian capital last summer, Aberdare completed an order for a large amount of h.t. power cable early in December last.

E.D.A. Sales and Service Conference

PRELIMINARY details have been announced of this year's Sales and Service Conference organised by the E.D.A. It will be held between 6 and 9 Apr., and the majority of proceedings will be at Caxton Hall, Westminster. Exceptions will be the general discussion and conference luncheon on Friday, when the venue will be the Connaught Rooms. The conference will be opened by Sir Henry Self.

Other speakers include Mr J. Gogan on "Organisation of Sales and Service to the Consumer"; Mr R. E. Gamlen on "Selling Electricity"; Mr J. W. Moule on "Electric Floor Warming"; and Dr A. G. Beverstock on "Training Commercial Staff." "Electricity for Productivity" and "Scope of Electronics in Industry" will be the subjects of Thursday's papers by Messrs J. R. Anderson and W. P. Warren.

New E.A.W. Branches

THREE new E.A.W. branches have been formed in recent weeks. Inaugural meetings took place at West Bromwich and Nuneaton on 29 Jan. and 2 Feb. respectively. Perhaps it is wrong to say that a new branch was formed at Whitefield, Manchester, because in fact members there have been granted branch status. Total number of the Association's branches has now risen to 135.

Cheaper Rates for Night Use of Electricity?

ALTHOUGH the electricity supply industry came through the recent cold spell with flying colours, there are still many problems to be faced by the B.E.A. and individual Boards. One of these is the more even spreading of the load, and we hear that the Midlands Electricity Board has a solution under consideration.

Speaking at Wolverhampton last week, M.E.B. chairman, Mr W. S. Lewis, said the Board was considering offering special rates to consumers who could make more use of electricity at night. If large commercial consumers could do some of their space heating at night, he said, the Board would be pleased if they would contact them to try and evolve a helpful scheme.

Mr Lewis said he had been amazed at the consumption figures during the fortnight of cold weather. Generating capacity in the Midlands has risen by 50%, but to meet the peak demand power-stations had to work at full capacity. To help reduce the cost of electricity, he said, it was desirable that the load be spread more evenly throughout the day, and that could be achieved by providing cheaper electricity at special times, which, he added, would offer special inducements to "fill up the valleys in the graph of demand."

N.E. Women to Confer

TEACHERS in the Newcastle area will be the next to benefit from a fourth one-day conference on Electrical Housecraft to be organised by E.A.W. It will take place on 27 Mar. at the Northern Counties' Training College of Cookery and Domestic Science. Conference fee is 7s. 6d. and applications to attend should be submitted by 13 Mar. This conference follows the success of previous courses in the south-west, north-west and Yorkshire.

OFFICIAL PUBLICATIONS

BRITISH STANDARDS.—B.S. 2082: Code for disappearing-filament optical pyrometers; P.D. 1782: Amendment No. 1 to B.S. 7: 1953 (Rubber-insulated cables and flexible cords); P.D. 1752: Amendment No. 1 to B.S. 546: 1950 (Two-pole and earthing-pin plugs, socket-outlets and socket-outlet adapters); B.S. 800: Limits of Radio Interference; B.S. 727: Characteristics and Performance of Apparatus for Measurement of Radio Interference.

SCOTTISH PEAT COMMITTEE.—Report of H.M.S.O. 5s. (see page 234).

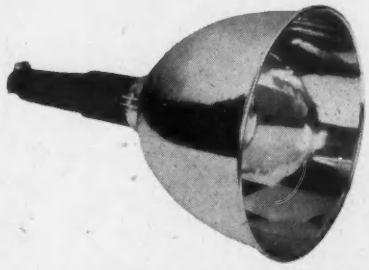
ATOMIC ENERGY BILL.—House of Commons Bill 66 H.M.S.O. 6d. (see page 258).

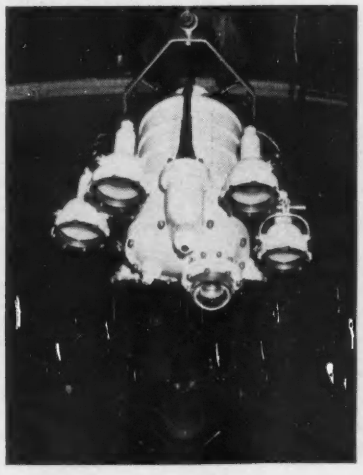
EUROPEAN STEEL MARKET IN 1953.—U.N. Report available from H.M.S.O. 5s.

Exhibition of Ultra Violet Apparatus for Industry

AS previously announced an exhibition of U.V. Ray Apparatus for Commercial and Industrial Consumers is being held at the Midlands Board's industrial showrooms in Chester St, Birmingham, between 15 and 26. Feb. The apparatus and processes being demonstrated include fluorescent crack detection in metals and plastics; a U.V. water steriliser; photo-polymerisation of plastics and synthetic finishes; photo-isomerisation in producing vitamin D; detection of minerals, forgery and fraud, air sanitation; U.V. chromatography; and fluorescence analysis. The exhibition is open on weekdays from 10 a.m. to noon, and 2 p.m. to 4 p.m., and on Saturday from 10 a.m. to noon.

ELECTRICAL EQUIPMENT IN SEARCH FOR COMET





Routine has taken over from the sensational in the recovery of the Comet Airliner which crashed off Italy on 10 January. Another underwater TV camera (right) is being flown to the scene of the crash. It is a Marconi-Siebe, Gorman camera fitted with a periscopic lens which can see in any direction within a hemisphere. This lens can be rotated by remote control through an arc of 360° and elevated through 90°. Already in use in the salvage operations is the underwater floodlight (above) with Osram 1,000 W. lamp and fitting developed in collaboration with the Admiralty Research Laboratory by the G.E.C. The lamp is a 100 mm. diameter round bulb with 1 mm. wall thickness capable of withstanding pressure at about 1,500 ft. Fitting is merely a simple reflector giving mechanical protection

Non-Strikers Fined?

CONTINUING its strike tactics, the Electrical Trades Union called out about 350 electricians in Northern Ireland for a week's strike on Monday, and some 300 men employed by two Midland firms were brought out on Wednesday for a similar period. In addition the union staged a one-day strike in London again on Tuesday, when about 9,000 members stopped work. To consider the position, the E.T.U. held a meeting at Earl's Court.

According to a statement by Mr L. C. Penwill, director and secretary of the National Federated Electrical Association, certain members of the union who remained at work during the one-day token strike on 18 Jan. have been fined by the E.T.U.

CITRINE TO PRESIDE AT MEETING WITH E.P.E.A.

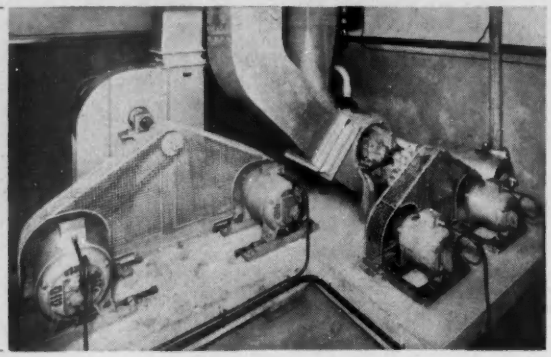
THE Action Committee formed by the Electrical Power Engineers' Association has been invited to meet the B.E.A.'s Labour Relations Committee on Wednesday, 24 Feb. On this occasion Lord Citrine is to be in the chair. This was decided upon at last Thursday's meeting of the British Electricity Authority when the E.P.E.A.'s request for a direct meeting was considered. The Association have thus been granted the facility which they sought, and they will be able to forward their claim for a substantial improvement in the status and salaries of engineers and technologists in the electricity supply industry.

North Met. Branch Thrives

THE N. Metropolitan branch of E.I.B.A., formed only recently, is now well established, we hear, and in extending its work, would welcome news of cases in need of assistance. The hon. branch secretary is Mr T. Tule, at the B.E.A. Eastern Division's offices, Northmet House, Southgate, N.14. On the lighter side the branch's first annual dinner and dance is to be held at the Waterend Barn Restaurant, St. Peter's St, St. Albans, on 24 Mar. Tickets are 30s.

Novel Lecture for Newcastle Contractors

A NOVEL method of giving a talk on display lighting was adopted by Messrs R. J. Fothergill and R. L. C. Tate at a meeting of the E.C.A. in Newcastle earlier this month. Motor coaches were hired for the occasion and the audience was taken on a tour of the city's shopping centre. When an apparently interesting installation was seen, the lecturers disembarked and armed with "walkie-talkie" apparatus proceeded to describe and discuss the lighting. Their commentaries were relayed to the audience in the coach through loudspeakers. Special arrangements as regards call signs and wavelengths were made with the G.P.O., we understand. About 50 contractors took part in this experiment, and afterwards returned to an hotel for refreshments and further discussion.



Two ventilator fans at the Paddington Green C.D. control centre. Fresh air fan is on the right, whilst the fan on the left is brought into use in a gas attack. Each has duplicate motors and starters

Electrical Plant in C.D. Control Centres

THE countryside network of Civil Defence report and control centres is rapidly taking shape. In London alone there are to be over 100 of these centres, a number of which have been completed and fully equipped. These underground buildings incorporate large control and other rooms, including a plant room with stand-by generating set or sets, and switchboard which take over electricity supply in case of emergency. One such centre was recently opened at Paddington Green.

In order to meet every possible emergency, a comprehensive heating, ventilation and emergency generator plant has been installed by G. N. Haden and Sons, Ltd. Two fans have been provided, each capable of delivering 1,000 c.f.m.

Mains electricity for heating, lighting, cooking and driving the exhaust fans is controlled from a switchgear panel, but in the event of a breakdown, essential power is supplied by a generator set provided by R. A. Lister and Co., Ltd. This comprises a FR2 diesel engine developing 16 h.p. at 1,500 r.p.m. direct coupled to a generator with an output of 8·5 kW at 400 V, 3-phase, 50 c/s.

1954 Minibition at Harrogate on 30th Sept.

THE popular "Minibition" organised by the Purchasing Officers' Association in conjunction with their annual conference will again be held in 1954. This year's conference will take place at the Royal Hall, Harrogate, from 30 Sept. to 2 Oct. It will be the fifth Minibition, the idea having been inaugurated in 1950. The nature of displays will be the same as in previous years, with stands of standard size and design. The quality of displays has improved steadily and last year it was decided to hold a competition to determine the best displays based on the educational nature of exhibits as well as attractiveness of layout. That competition will be repeated this year.

The First Half-Century

Last week Mr S. E. Britton propounded before the Glasgow Section of I.E.E. the conundrum "Should Electric Supply Undertakings Advance Motors on Hire or Hire-Purchase Systems?" After considering with an unbiased mind, the pros and cons, he decided that the pros had it. The argument, in short, was much to this effect: The supply undertaking wants to get a day load and to encourage the use of electric motors; the small user won't buy a motor right out; he will go on with manual labour, or put in an "obsolete" secondhand gas engine; but he may be persuaded to hire, with or without the option of ultimate purchase. Therefore the undertakers, especially in a small place, should try to push the use of electric power by hiring out motors.
—*From our issue of 18 Feb., 1904.*

Mr R. J. Fothergill describes a shoplighting scheme to his audience in the coach by means of a "walkie-talkie" set. Fifty contractors took part in the lecture tour of Newcastle's shops

Cable Co.'s Dinner-dance

EDUCATION provided the main theme at the Annual Staff Dinner and Dance of Southern United Telephone Cables Ltd., held at the May Fair Hotel on Friday. Mr W. F. Bishop, C.B.E., replying to the toast to the company, graciously proposed by Mr G. H. King, referred to the training scheme which the Board of Directors have recently devised. Aimed at the younger employees of the organisation, the scheme will enable these persons to acquire knowledge and background of the telephone cable industry. Proposing "The Guests," Mr E. J. Kidler was refreshingly brief, yet no organisation represented was ignored. In reply, Mr C. H. I. Chown wished the company a future as successful as that of its past.

COMPANY OPENS NEW TRAINING KITCHENS

A NEW kitchen has been opened in Pavilion Rd, Sloane Sq, S.W.1, by Jackson Electric Stove Co., Ltd., for the training of cooker demonstrators. Six girls can be taught the techniques of demonstrating and selling electric cookers each week. In addition facilities are provided for demonstrators with many years of experience to attend for refresher courses. This free training scheme has been operated by Jacksons for some 30 years now, and besides London, similar schools exist in Glasgow and Liverpool, and a fourth is to open shortly in Leeds. After the course the girls are either absorbed by the company as provincial area demonstrators and saleswomen, or by the Electricity Boards for work in local service centres. The majority of girls attending are sent by the Boards.

View of the new kitchen opened by Jackson Electric Stove Co., Ltd., for the training of cooker demonstrators

ENGINEERS SHOULD BE REINSTATED IN MANAGEMENT

BY restricting his training to the purely practical and technical side of industry, the engineer has allowed the management of the engineering industry to pass into the hands of men with little or no workshop experience. Such was the recurring theme of a lecture given to a meeting of the A.S.E.E. in London on Tuesday by Mr H. Bainbridge, works manager of the Chatwood Safe and Engineering Co.

His aim was the reinstatement of the engineer in the field of management, although many of his comments showed how the engineer had initially lost control of his industry. The result was a system of "scientific management" which had brought with it an army of non-productive specialists who had taken virtually all authority from the shop foreman.

Better Street Lights for Safety on Roads

FOR the pedestrian, it is some 2½ times more dangerous on the streets by night than by day. This general conclusion was reached by the E.D.A. Street Lighting Committee after instituting a study of official post war road accidents figures covering the years 1945-52.

Chief cause of the potential danger after dark was said to be poor visibility, and the only hope of remedying this situation lay in the provision of good quality street lighting. Present rate of modernising lighting installations will ensure safe lighting, nationally, only after some 15 to 20 years.

Such would be the reduction in the death roll consequent upon modern street lighting on a national scale that E.D.A. are urging that this restriction on expenditure for street lighting should be lifted.

The same afternoon it was stated in the House of Commons that a further £4 to £5 million would be spent on road maintenance, including provision of pedestrian crossings and lights.

CONCEALED LIGHTING FOR THE LOUNGE

An unusually elaborate fluorescent lighting scheme installed in the home of Mr G. Demmy at Prestwich, Lancs. A fibrous plaster core with glazed insets has been fitted with three lines of tubing, each separately switched and arranged for dimming. This installation was carried out by Brindle and Kirby Ltd., using fittings and lamps made by the General Electric Co.

M.E.B. opens New Training Centre

A NEW demonstration and training centre for domestic appliances has been opened by the Midlands Electricity Board in Albert St, Birmingham. It will be used by the Board's own demonstration staff but it will also be available to women's organisations, schools and clubs wishing to arrange courses in the use of electrical equipment. The new centre has a large room to accommodate permanent demonstrations, a kitchen for cookery training and a lecture room equipped for film shows. The opening ceremony was performed by Ald Mrs N. Hyde, a member of the Consultative Council. Mr Emil Braathen, manager of the Birmingham sub-area, said new apparatus would be added to the centre as it became available. Already installed are cookers, cleaners, washing machines and most of the small domestic appliances.

NEWS IN BRIEF

Farm Lighting is the title of the latest in a series of farm electrification illustrated broadsheets published by E.D.A.

A Canadian order for food and catering equipment worth £2,000 has been placed with Crypto Ltd. Complete range of Crypto products will be shipped soon to the British General Electric Co. (Canada) Ltd. who will be acting as sole Canadian agent. The same equipment will be exhibited at the International Trade Fair in Toronto on 31 May.

B. French Ltd., of Kidderminster, having almost completed electrifying the Isle of Skye, have been awarded a similar contract in Inverness. Value of the contract is about £275,000.

Nearly 1,000 employees and guests were present at the silver jubilee festivities of Hall Telephone Accessories Ltd.

Rheostatic Co., Ltd., held their annual dance at the Slough Social Centre recently.

Major, Robinson and Co., Ltd., celebrate their golden jubilee this year.

Hurseal Ltd. held their annual staff party held at the Kingsley Hotel, W.C.1, recently.

For the third successive year the 25-Year Club of Pressed Steel Co., Ltd., have held their dinner. One hundred employees with the necessary amount of service qualified for membership this year making a total of 328 to date.

QUESTIONS IN PARLIAMENT

Price of Fuel and Light

PERCENTAGE rise and fall in the price of various commodities and services were included in a written answer by Sir Walter Monckton last week during a series of questions on the Retail Prices Index. Figures in respect of fuel and light may be of general interest. Mr A. W. Lewis asked the Minister to state, using his cost of living index figures, the increase or decrease in the price of a number of items, including fuel and light, at specific times. Prices in Jan. 1951 were taken as 100. In June the index had risen to 103 and by Dec. to 110. In the same months in 1952 the indices were 115, 115 and 120. In June 1953 the figure was 121 and last Dec. it was 127. Figures are approximate only.

Cost of Hydro-Electric Schemes

CLOSER scrutiny of amounts authorised by Parliament for the N. of Scotland Board's constructional schemes, and the sums actually spent on those projects was advocated by Mr G. Nabarro. In his reply Mr J. Henderson Stewart said Ministerial consent for loans was required and consequently any difference in amounts borrowed and estimated costs could be checked easily. In six schemes completed between 1944 and 1947, cost was estimated at £12,060,000 and the sanctioned borrowing amounted to £27,825,600. In the case of seven transmission line schemes, estimated between 1947 and 1951 to cost £4,040,000, the sanctioned borrowing amounted to £4,714,870.

Scottish Board's Fixed Assets

ARISING no doubt from the previous week's debate, Mr G. Nabarro asked for details of the respective values of fixed assets of each of the S.W., S.E. and N. of Scotland H-E. Boards. Mr J. Henderson Stewart's reply, published in *Hansard* stated that on 31 Mar. last, the net value of the fixed assets of the S.E. and S.W. Scotland Boards totalled £9,210,028 and £15,057,691 respectively. This did not include the B.E.A.'s fixed assets in Southern Scotland. Net value of fixed assets of the Hydro-Electric Board at 31 Dec. 1952 was £78,318,654. Total for the whole of Scotland at that period was about £130 million, it was stated.

Highland Railways

THE Under-Secretary of State for Scotland refused to be drawn on the question of electrifying appropriate Highlands railway routes. He said the matter rested with the British Transport Commission. Mr G. Nabarro said that as responsibility for all electricity matters had now been assumed by the Minister, could he not support the N. of Scotland Board's chairman's plea for electric railways. Mr Stewart said the only answer he could give was that B.T.C. themselves did not consider electrification of those lines was warranted.

Interference Suppressors

THE Postmaster-General had received reports from committees advising him on television interference from small electric motors and refrigerators and it was hoped to lay regulations before Parliament shortly Mr D. Gammans told the House last week. Mr J. Harrison had asked what response there had been to the Government's campaign asking motorists and others using electrical appliances to fit suppressors. Mr Gammans said he understood more suppressors were being fitted on cars than previously, and it was therefore proposed to continue the campaign as before. Response to specific requests remained good.

TV Reception at Penbridge

AN allegation that there was faulty television transmission in the Penbridge area of Staffordshire was refuted by Mr D. Gammans. He told Miss J. Lee that the B.B.C. had informed him a strong signal was received from Sutton Coldfield in that area.

Load Shedding

PREVIOUS information on demand during the cold spell was repeated at Question Time last week. The Minister of Fuel and Power told Lt Col Lipton that there had been record demands for electricity and gas. It had been necessary sometimes to reduce voltage or pressure, but there had been only one small and short power cut which occurred on 25 Jan., when the system was taking up the steep rise in the load.

Electricity in C.D.

THE Civil Defence (Electricity Undertakings) Bill seemed likely to pass through the initial phases of Parliamentary procedure with scarcely a mention, but somewhat surprisingly its passage was arrested temporarily by a 45-minute debate. In the first place Mr L. W. Joynson-Hicks explained that the Bill was designed to enable the Minister of Fuel and Power to make regulations requiring and assisting the industry to ensure its "due functioning" in the event of hostilities. It arose from the repeal of previous arrangements of this nature in the course of drawing up the 1947 Electricity Act, and in effect reintroduces the electricity supply industry into the 1939 Civil Defence Act. Mr Joynson-Hicks said the Bill was purely an enabling measure and did not cover any specific works, grants or similar items.

The amount of time which had elapsed before the Bill was placed before the House was the main concern of Mr J. MacColl who asked what was the nature of the grant to be made and what were the terms of the grant. Mr A. Palmer said it was estimated that during the coming year just over £1 million would be spent, which would not go very far. He also queried the extent of defensive measures in the face of possible atomic warfare. He also asked why the BEA will get only a 52½% grant while other authorities would receive much more.

Replying Mr Joynson-Hicks pointed out that it was intended to ensure that the most vulnerable points of the industry were either protected or duplicated. On the question of delay he said he was well aware of it but did not think anything had been lost by it.

Atomic Energy Bill

THE BILL providing for the setting up of an Atomic Energy Authority for the United Kingdom received its first reading last week. Closely following the White Paper on the subject, the Bill proposes the creation of a non-departmental organisation, responsible under the direction of the Lord President of the Council for research and development in the atomic energy field. The proposed Authority would consist of a chairman and between six and ten members. Three of these would be atomic energy technologists, and one other an expert in administration and finance. Powers under the Atomic Energy Act, 1946, and the Radioactive Substances Act, 1948 would be transferred to the Authority, but it would develop and produce atomic weapons only under arrangements with the Ministry of Supply. There is provision for the Lord President to give directions to the Authority, but he "shall not regard it as his duty to intervene in detail in the conduct by the Authority of their affairs unless in his opinion overriding national interests so require." An annual report would be made, but certain matters may be withheld from publication in the interests of national security. There are the usual provisions for settling the conditions of employment.

Lighting Housing Estates

ASKED to make a statement on the requirements of street lighting on housing estates, Mr H. Macmillan pointed out there was no specific requirements. Local authorities submitted their proposals, and when considered the suitability as regards security and road safety were taken into account. If there was a particular case in mind, he invited Mr K. Thompson to let him have details.

Wires and Cables

A STATEMENT on the position regarding the Monopolies Commission's Report on electric wires and cables would probably be made shortly, Mr A. R. W. Low stated in a written answer last week.

INDUSTRIAL MAINTENANCE

A special monthly section of the Electrical Times

Some Points about the Electricity Regulations

Part 2

by H. W. SWANN, O.B.E., D.F.H., M.I.E.E.

IN the previous article* in this series I discussed the electrical sections of the Factories Act 1937, finishing with the sub-sections of Section 103 dealing with the definition of electrical stations. The one sub-section remaining to be discussed is (5), the last of the electrical group, and this merely tells us that electrical energy is not to be deemed to be an article.

Electricity Regulations

The Electricity Regulations 1908 were rechristened in 1944 by S.R. & O. No. 739 and are now known as "The Electricity (Factories Act) Special Regulations 1908 and 1944." The older code retains its identity as the "principal" regulations but a new one extends its application, adds an exemption to stop it going too far, and amends part of Regulation 18. This last mentioned change arose on a fine point of law in a case which went on appeal to the High Court. A man had been sent to work in a high voltage switch cubicle in the side wall of which was an aperture for the bus run, through which the live end the other side could be touched. An accident occurred and we followed it by prosecution which was, however, unsuccessful, because it was held that the regulation only required the occupier to make dead the section on which work had to be done. We were told for the first time that the sense of the regulation which we thought *required* the separation of the dead cubicles from its live neighbour was only permissive. Although the aperture *could* have been covered there was no obligation to do so.

The new revision of the regulation gets over this weakness and the reason it was not discovered earlier probably lies in the involved character of the phrasing.

ELECTRICITY REGULATIONS 1908 AND 1944: FREE EXTRACT OF EXEMPTION 2.

> Nothing in these Regulations shall apply to service lines and apparatus on the supply side of the consumers terminals provided that no live metal is exposed.

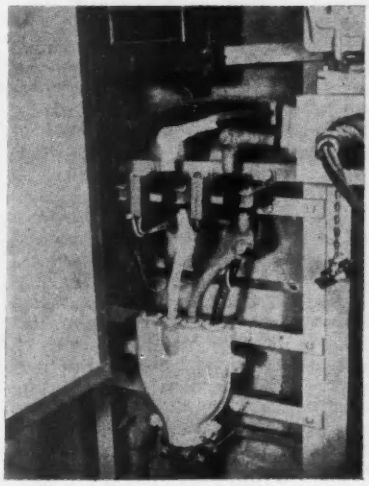
One would hardly expect salient points of importance in the exemptions from the regulations, but several rather stick out. Although Swinburne's objectors eventually agreed to the application of the regulations to electrical stations they secured an exemption for service terminations on consumers' premises. I have come to regard Exemption 2 as a little unfortunate.

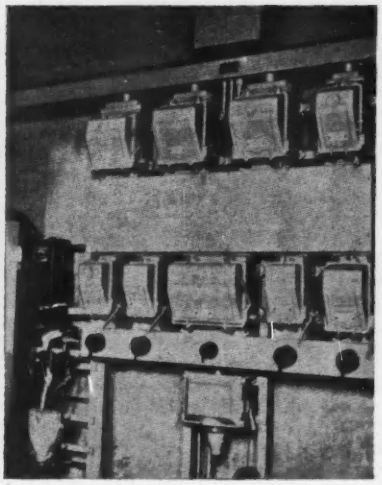
Service Terminations

The average assembly of cable end sealing box with fuses and meter mounted on a board often involves loose lengths of wire with a lack of finish that may compare badly with the consumer's arrangement of main switches and distribution fuse gear. When this occurs on factory premises, the occupier's engineer has some reason for suggesting to an inspector that what is sauce for the goose might be suitable for a gander. On other classes of premises it sets an example which is readily copied, and although in recent years there has been much improvement resulting from the availability of manufactured assemblies constructed to a design, many of the older terminations have to be seen to be believed. In one or two cases where a factory engineer has made a really good job alongside a poor and unsightly supply service I have suggested that he should send a photograph to the supply people.

I remember one occasion where Exemption 2 was invoked in an ingenious defence during legal proceedings which followed an accident in a supply substation. A fitter with a job of work to

Neat consumer's board marred by unsightly supply service. (Crown copyright reserved)





**This article is continued from Industrial Maintenance, page 12, published in the* ELECTRICAL TIMES, *21 Jan., 1954.*

do sat on top of a transformer into which the live high voltage supply was taken by rubber insulated cables. The installation had deteriorated and he sustained burns to the base of the spine. The defence submitted that as this substation was necessarily on the supply side of all the consumers terminals in the area served it was exempt from the regulations. The justices supported this view and it was thus necessary to go to appeal, because the logical extension of such a defence would exempt all the generating stations. The High Court took a different view however, and considered the exemption to be of local application only.

There have been some cases where a failure of a service cable on factory and other classes of consumer premises has caused fire. The overcurrent protection in such cases is that of the main distributors which may be stiff, and also in parallel with other distributors in the network. Whilst a burn-out of a service cable buried in the earth may not be a serious matter there is risk if it happens under the floorboards.

In one case which I investigated myself, the service cable had been laid under the floor of an office to a factory at the back, and a failure of the cable had set the place on fire. In another the service to a dwelling house had been laid alongside and touching an iron gas service pipe both traversing the length of the dining room floor to the kitchen cupboard. Failure of the cable sealing end box caused heavy current transfer to the gas pipe in which holes were burnt, releasing the gas which quickly filled the space under the floor and exploded. It was ignited probably by arcing between cable sheath and gas pipe as the latter burned clear. The cable sheathing was not effectively bonded to the distribution sheathing at the external service joint. There have been other cases of fire caused by failures of service cables or end boxes one of which came within my own experience when I was a supply engineer. It did not seem necessary to say much about it at the time, but I have since wondered whether there could be other engineers with similar experience.

Service Cable Protection

If the exemption had not been operative I think the inspectors would have had to consider service cable protection in the same way as that for the factory occupier's main feed cables especially where appreciable lengths are laid on premises where there may be inflammable materials or some other fire risk above the average. Supply undertakers usually reserve the right to say where the service cable should go, and their object would be to keep it as short as possible. In certain cases there might be justification for laying service cables in sand or pulling them into pipes, and it would undoubtedly be bad practice to fix a termination in an area when there might be inflammable vapours or solvents. This last point might with advantage receive more consideration in gas making works, where there is often large scale use of electricity.

Exemption No. 4 has always been of importance and the proviso places much undefined responsibility on both the occupiers engineers and the inspectors. Swinburne's committee of 1908 could not have anticipated the weight which now attaches to this proviso, because electro-chemical and thermal processes must then have been on a much smaller scale than at present. These interests do not in fact appear to have been represented on the Committee un-

ELECTRICITY REGULATIONS 1908 AND 1944: EXEMPTION 4 (IN FULL).

Nothing in these Regulations shall apply to any process or apparatus used exclusively for electro-chemical or electro-thermal or testing or research purposes: provided such process be so worked and such apparatus so constructed and protected and such special precautions taken as may be necessary to prevent danger.

less they were covered by the Castner-Kellner Alkali Co., Ltd., one of the firms in the list for who Dr Merz appeared. There were no specialised people present and the committee was probably glad to dispose of four awkward subjects, about which they could hardly have been well informed, by lumping them together and leaving the interests concerned to work out their own salvation.

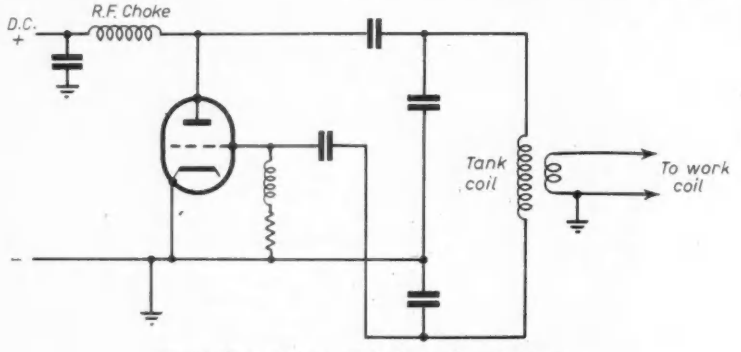
Although I think this was a wise decision I cannot help remembering that at an earlier point in the Inquiry the objectors feared strained interpretations of the regulations by some future Electrical Inspector. This fear must have been forgotten when they accepted this open proviso which does not require an inspector to interpret anything, but only to form an opinion as to what special precautions seem to be required.

Actually, of course, the engineers who have to run these specialised jobs know more about the precautions required than anybody else, but in my experience they often wish for the co-operation of an inspector and in fact also liaison has been established in many places. This works both ways—the inspector learns something about the process, or testing work, and the engineers learn something about the inspector. After that both are better fitted to devise and agree on the precautions which are desirable and which the Exemption requires.

Arc Furnaces

I have however had some jolts on occasion such as when I saw a man working inside the top section of a large, long, live electrode for an arc furnace. The job was to tack-weld the cylindrical metal containers which hold the material of which the electrodes are built as a continuous process. The engineers said he was safe as a bird on a live overhead wire, but seeing no wings, I thought he might have to climb in and out. This proved to be correct and in the operation he came nearer to earthed metal than was perhaps safe, so we tried to devise another way of working. My second fear as to whether the man could fall right through the electrode tube into the fiery furnace was unfounded.

In the years before the war some trouble was experienced in connection with the high voltage circuit breakers controlling transformers for the large arc furnaces in Sheffield. The switchgear manufacturers had supplied breakers,



A typical circuit for an h.f. electro-thermal process

correctly rated for the duty, of the same type as would be specified for electric supply service where, however, the number of occasions on which they were likely to be operated were comparatively few. When they were operated by the furnace men, say 20,000 times a year, some of them were unable to stand the racket, and mechanical troubles led to electrical failures of explosive violence, attended by some loss of life. I asked the B.E.A.M.A. switchgear committee for advice and in the event we recommended the steel makers to adopt a joint scheme of maintenance under which the manufacturers serviced the switchgear at intervals, based on the frequency of operation rather than at stated times. In some cases it came down to two months between services and the scheme proved effective.

Earthing Molten Steel

When the first high frequency (about 1,200 c/s and 1,200 volts) steel melting furnaces were put to work in the Sheffield area I thought the melt, which formed the secondary of the "transformer," should be earthed because the operators were putting long tools in, and it seemed to me that the melt might acquire potential from the water-cooled primary coils by reason of erosion of the furnace re-

fractory linings. It proved difficult to earth molten steel, although something has since been done with it, and instead we tried to make the surroundings earth free. The usual materials such as wood were a little out of place under such conditions and my colleague Mr Cooper suggested that the floor should be formed of fire-bricks standing on edge and packed closely together.

As we acquired experience of this type of electro-thermal process we found that erosion of the refractory did in fact take place leading to a gradual increase of primary current which was tolerated up to certain limits, after which the refractory lining was renewed. Thus it seemed that precaution was justified and I do not remember cases of accident.

Electrical Testing

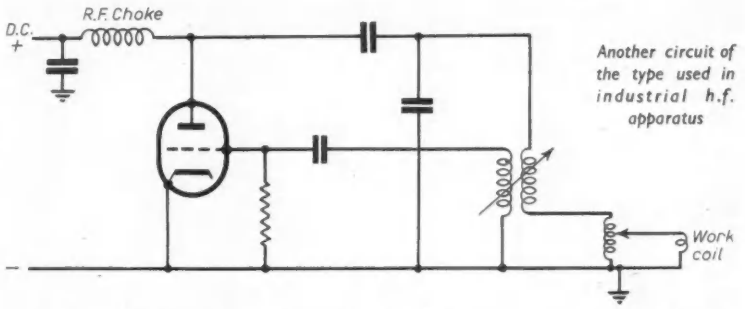
In electrical testing work conditions at various works differ widely because of the nature of the products. It may be required at the bench in the course of the process or at the final stages and may often include performance and pressure tests.

A good example of testing during construction is seen in the radio industry, where it is done stage by stage. Some situations can be made earth free but in others earthing is required for purposes of the test and it is not always easy to achieve consistent practice. In other forms of bench testing, where girls may be sitting and are thus reasonably well insulated, the engineer aims at preventing shock across the chest by suggesting jigs to hold the component under test, the control switch (or switches) being so fixed as to make the girl hold them in, or press them down, so that her hands are located out of harm's way.

It is just as well also to keep a girl's feet out of harm's way, a point which came under notice when I was visiting a factory making early types of electronic valves. The anodes were being "bombarded" during the gettering process, using a 2,000 volt 50 cycle supply derived from a 1 kW transformer, situated under each bench. The girls sat on high stools, most of them with their feet perched on the transformers, all terminals of which were exposed. They said it kept their feet warm and looked at me with some dislike when I suggested they should take them off. I found a teapot on one transformer and really felt almost inclined to believe the maintenance engineer who claimed that the set up was quite safe. The factory manager who was with us shared this view and offered to demonstrate how safe it was by touching an h.t. terminal. In my inexperience I most foolishly failed to stop him doing this and, as he was not sitting on a stool, he got a shock which sent him some distance but fortunately not all the way. He had only flicked the terminal lightly but the affair taught us both a lesson. He had all those transformers taken out that afternoon and replaced next day by Ford car ignition coils which were, of course, of much lower energy output.

This insight into early electronics took me to other factories making valves and presently I developed a testing technique for the h.t. source of supply to valves undergoing bombardment. I found that if a spark from the transformer, or induction coil, penetrated cleanly a single sheet of my official S.O. notebook then I could tolerate the shock, but if the holes were burnt there was too much energy in the circuit and I requested the maintenance people to provide higher values of inductance or resistance.

It is perhaps as well to add that both the valve makers and the inspectors have now adopted much improved methods.



Another circuit of the type used in industrial h.f. apparatus

Electronics

The maintenance engineer in a valve making works, or, say a factory making radio sets, enters the field of electronics in industry but his interest is rather different from that of his brother who is looking after the power and lighting in a factory which makes use of some electronic application in the process. In the first case the engineer may have grown up with the specialised plant and equipment and plays an active part in its installation, enlargement, and improvement as well as in its maintenance. If, however, the management of a concern making, say, tin cans, decides to purchase some electronic equipment, an engineer accustomed to heavy power work may be at a disadvantage if the new gear gives trouble.

A lot of this kind of equipment probably falls under Exemption 4 as an electro-thermal process, so that regulations do not apply *provided* the engineer takes "such special precautions" as may be necessary—a dictum which is all right if he has some idea of what they are. There is more to be said about this but at the outset, it is as well not to start taking the back cover off because the interlock on the front door is too good to be defeated.

Cable Testing

I used to work in a cable works test department in my youth, and although I do not remember seeing an inspector, the rules governing pressure test routine were rigid and the job was entrusted only to experienced and responsible members of the staff, a restriction which excluded me.

The testing arrangements in the larger cable makers works have been evolved over the years and incorporate well considered systems of signal lamps, gate interlocks and elevated control rooms permitting full observation of the test area. Some of the earlier accidents occurred because workpeople behind cable drums, or other obstructions, were not seen and thus the warning lights are usually supplemented by audible signals.

Customers' engineers witnessing cable tests sometimes used to ask for "end flashing" to prove that pressure was actually on. This meant somebody remaining within the testing enclosure to earth or short circuit the ends, and as accidents had occurred we strongly discouraged the practice.

Although present day test pressures are very high and involve new methods, such as impulse testing, the precautions seem to be effective and where routine is possible it appears to be established in the minds of manufacturing engineers and is handed on. Conditions are different however when pressure tests are called for on customers premises, and having done some of this sort of work, I know that it is difficult to guard against the unexpected. A good plan is to rope off an area and make every one of the helpers, onlookers and workpeople into point watchmen with instructions to stand fast after they hear the whistle and allow no one to pass.

A good example of the kind of electro-thermal process which could hardly have been in mind at the time the Regulations were written lies in the application of high frequency supplies to such jobs as tool tipping, glue setting in plywood, moulding plastics, and other forms of dielectrics heating. When I first saw a plywood press taking about 100 kW at high frequency, and felt one or two hot spots in the expanded metal screenwork of the work enclosure, I asked the leading operator whether he had any money in his pocket. I was misunderstood, but the plant man with me took the point and said that of course no one was allowed in the enclosure when the press was energised, and he explained the details of the door interlocks. He told me afterwards, however, when we had got to know each other better, that his overall had gone on fire as a result of carrying a few turns of copper wire in the pocket, an admission which underlined the well-known fact that an interlocked door is often capable of being closed from inside as well as outside.

A good many engineers have told me quite frankly that when some trouble or other develops on complicated equipment

Two batteries of electrolytic cells, each consisting of 240—1,500 amp cells. Voltage per battery, 530; production 3,280 cu metres hydrogen per hour

it has to be diagnosed before it can be remedied and that they have to get close up for observation and testing whilst the gear is live. It is for this reason that I have advocated generous instrumentation of electronic applications, especially those for heating, so that an indication of what is happening in the various groups of rectifiers and oscillators can be seen from outside.

Early Switchgear

Points like this arose 40 years ago when the first switchgear assemblies for public supply went wrong, and led to people entering switch rooms where most of the high and low voltage equipment was exposed live, to find out what was the matter. The occurrence of accidents led the Factory Department to ask for cubicle constructions with means of section isolation. Again, when the first large scale steel tank mercury arc rectifiers were put to work they were enclosed as a whole to keep people away from the live anode cylinders, but plant men went inside to look at the oil lubricating rings in the bearings of the vacuum pump motors and, in a case I found myself, used a ladder to get up to a valve wheel at the top. This is all back history now, but it was found possible to mechanise controls to external handles and in other ways to rearrange assembles so that they could be operated from outside. Where groups of glass rectifier tubes were used we asked the manufacturers to divide them into sections with the associated gear, each provided with instrument, and each capable of individual isolation. The same point is arising again with large-scale h.f. electronic applications starting, as it always does, with equipment which can only be shut down as a whole for service and repairs. It is in these initial stages of new developments that plant and maintenance engineers find themselves accepting risks to which a later generation will not be exposed because manufacturers will have improved their designs to take account of maintenance requirements.

Manufacturers are perhaps at some disadvantage over things like this because when some new development is marketed its price is always more than the customer wishes to pay for something which he has hitherto done without. When its usefulness becomes established the customer will cheerfully pay more for improvements in design, especially if he has thought of them himself.

After seeing other high power h.f. processes, and learning that still larger equipments were on the way, I wondered whether assemblies which could both set glue and set an engineer's pocket on fire, might be capable of unsettling his inside. I asked the doctors about it, including a distinuished authority who specialised on electrical treatment such as h.f. for deep therapy. The apparatus used in his clinic ranged around 2·5 kW and direct applications to the patient were said to occupy about seven minutes a time. Although there is no direct personal application in industrial processes some of the routine jobs bring people fairly close to h.f. "work coils" e.g. in tool tipping, and as the power output is much higher than in hospital treatment I made further enquiries which led me to a research organisation where points somewhat similar to that I had in mind had been studied and conclusions, based on experiment, has been reached. I was able to obtain much information which was of a completely reassuring character.

My hospital enquiries elicited one or two stories which compared with the fire in the engineer's pocket rather than with physical effects of h.f. In one place there had been some celebrations after which tinsel trimmings and such like were put into a cupboard backing on to a thin partition. On the other side of this was a room for h.f. treatment and when they started on the first patient next morning the trimmings in the cupboard went on fire. In a factory such a room would of course have been completely screened by expanded metal work, or its equivalent, but it does seem evident firstly that there are cases where the design of the h.f. treatment may permit stray fields, and secondly that expanded metal screenwork may have a fire prevention value as well as arresting interference with radio signals.

Incidentally, I ran into a case many years ago where radio broadcasting interfered with an industrial process—to wit a job of building flats in Portman Square. I had received complaints that men unloading lorries at the kerbside got shocks from the hook at the end of a wire from an electric crane. I thought the crane motor, or some wiring, was defective, and made tests which, however, showed nothing wrong—not even the earthing. At the time when I made the tests I could discern no shock and I was somewhat sceptical. I visited again and this time found out that the trouble was experienced only in the afternoon and as I stood at the top of the crane tower, thinking, I saw the transmitting aerial of 2LO on the roof of Selfridges I had just made a crystal set and knew that 2LO broadcast only from the afternoon onwards, so I went across the road and saw a gentleman who knew all about it, and still does. They had experienced a similar effect when men building an extension to Selfridges were swinging steel girders into position and they very kindly looked into my problem. It transpired that the length of the loop formed by the crane tower, jib and wire rope was about right to resonate the frequency of 2LO (or perhaps it was the third harmonic) and the men unloading lorries were in fact drawing little sparks.

Electro-Chemical Plants

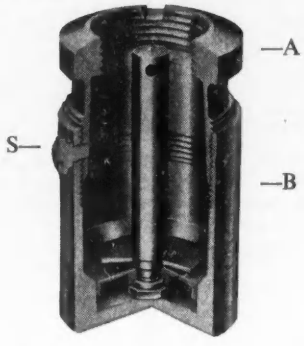
There are many electro-chemical plants involving some form of electrolytic process for a wide variety of purposes. Most of them operate on voltage ranges up to 200, a figure which, on a d.c. system, seldom leads to shock accidents but in late years there have been considerable extensions of these processes which have led to the use of higher voltage mainly because of the enhanced efficiencies which became possible. When plant designers are thinking in terms of cell current densities upwards of 10,000 amperes to say 50,000 or higher, for continuous night and day operation, small gains in efficiency are of the utmost importance. For that reason there are cases of direct generation on site for the process only whilst elsewhere the plans have sought to improve on rotary converters at say 88·2% efficiency by installing mercury arc rectifiers, which at voltages above 600 may be expected to achieve about 92·7%. There are other considerations also such as the cost of the massive copper bar cell conductors, and the losses therein, with questions of the number of cells in a series and it can be appreciated that this upward trend in development has posed some new safety problems for the engineers concerned with operation and maintenance.

(To be continued)

George Ellison Adjustable Time Lags

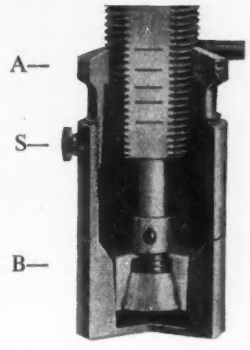
DATA SHEET 2

SINGLE ACTION TIME LAG



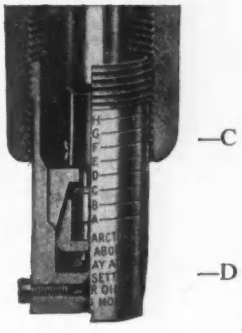
Single Time Lag. Suitable for circuit-breakers and starters where normal, but not excessive current fluctuations occur. On heavy overloads it will trip without any time lag. This design, which has been in use for many years, uses a normal oil-filled dashpot. The ratios of time delays relative to standard are determined by screw action and also by the viscosity of the oil used in the lag.

DOUBLE ACTION TIME LAG



Double Time Lag. For use on circuit-breakers and for switching large squirrel-cage motors d.o.l. This time lag has a by-pass valve in the piston which closes under the relatively heavy pull when the motor is starting, and retards operation of the breaker until the motor is up to speed without giving too much retardation on normal overloads which do not close the valve.

TRIPLE ACTION TIME LAG



Triple Action Time Lag. This is similar in construction to the double time lag, but has an additional action that allows quick return of the piston after operation. It is used on "Bantam" and "Ellison" circuit-breakers and starters and on relays. Adjustment for time delay is obtained by varying the viscosity of the oil. Sleeve D is calibrated in letters on contactors and starters, but in percentages on relays.

The time lag permits starting currents and momentary overload peaks to pass, but allows the overcurrent release to operate on persistent overloads with quick resetting. The sudden pull caused by the starting current closes a spring valve in the piston and automatically adjusts the retardation. When the current has become normal, the valve opens and the plunger is free to release at the overload for which it is set. Short circuit currents cause very rapid operation.

Setting the Triple Action Time Lag. Unscrew the dashpot D (saw kerf in bottom) and fill with oil up to ½ in. above the piston, *with the piston in position.* Replace dashpot and select overcurrent mark indicated by the edge of the body (C). Replace set screws.

Action. In both single and double time lags, the pistons are tapered and the cylinders bored to correspond. The tapered form of the piston permits adjustment of the relaxation by raising or lowering the cylinder (B) and thus varying the clearance between the cylinder and the piston. This adjustment will control the rate of flow of the oil between the two ports and so vary the time of operation. The single and double time lags are made in four sizes.

Setting the Single and Double Time Lag. To set the time lag remove the locking screw (S), unscrew the cylinder (B) and fill with oil to the level mark *without the piston.* Rescrew cylinder on to A until the hole number for the required setting registers with the tapped hole. Refit screw S. The percentage overload required is obtained by screwing part A until the number required is indicated. The time lag is varied by the position of the sleeve (B). The lower the number selected by the screw (S), the quicker the action, which is also dependent on the viscosity of the oil used. (See below.) *Do not interchange cylinders when cleaning or filling with oil.*

Choice of oils. The lighter grades of oil used in motor car engines will generally be found satisfactory for use in time lag dashpots. Switch oil, as supplied for use in the tanks of oil-immersed gear, will seldom give sufficient retardation and may cause unnecessary stoppages through frequent tripping

General Maintenance. Keep clean; avoid fluff from cleaning materials; maintain correct oil level; do not interchange cylinders.

Time values for hole 8, with "Gargoyle Mobiloil Arctic" oil, at about 60° F.

Per cent o-load on setting ..	10	25	50	75	100	150	200
Seconds delay	92	45	24	16	12·5	8·5	6·5

Time ratios of other holes relative to hole 8.

1	2	3	4	5	6	7	8	9	10	11
·02	·08	·12	·16	·33	·47	·75	1·0	1·4	1·7	2·2

Ratio of times to standard for various oils and temperatures—all three time lags.

Grade of Oil	Temperature °F.					
	50	60	70	80	90	100
Switch oil ..	·22	·17	·12	·10	·07	·05
Mobiloil Arctic..	1·6	1·0	·64	·43	·30	·22
Essolube Med.						
Heavy	—	2·6	1·7	1·3	·82	·61

Times at hole 3, using "Gargoyle Mobiloil Arctic" oil at about 60° F., with overload trip set at 25 per cent.

	Valve closed (starting)			Valve open (running)	
Motor current: % full load ..	700	500	300	200	150
Seconds delay..	8·5	13·0	21·0	17·5	35·0

Time ratios of other holes relative to hole 3.

Hole ..	1	2	3	4	5	6	7	8
Valve closed	·42	·83	1·0	1·4	2·4	4·9	10·0	19·0
Valve open	·80	·90	1·0	1·1	1·2	1·25	1·35	1·45

See table in left-hand column for ratios of times with oils other than "Gargoyle Mobiloil Arctic."

Times when using "Gargoyle Mobiloil Arctic" oil at about 60° F. with overcurrent trip set at 25 per cent.

	Valve closed (starting)			Valve open (running)		
Motor current: % full load ..	700	500	400	250	200	150
Seconds delay	6·0	9·0	13·5	12·0	20	52

Time values for switch oil at about 60° F. with the overcurrent trip on 25 per cent.

	Valve closed (starting)			Valve open (running)	
Motor current: % full load ..	700	500	350	250	150
Seconds delay	9·0	14	21·5	4·5	14·0

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GEARED JOINT

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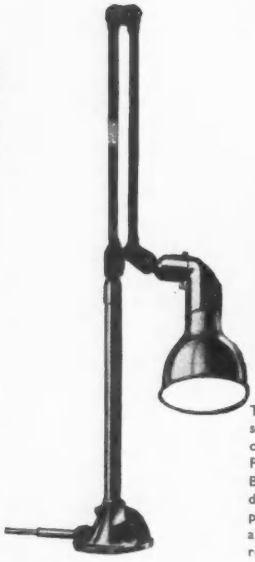

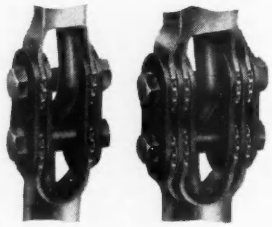

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COMPONENTS for bicycles are produced by mass-production methods but with close attention to quality and finish. Large numbers of machine tools, including some intricate automatic designs, a variety of plating baths and heat treating sets, and heavy duty welding machines are all involved, and they lend a variety to the work which has to be undertaken by the electrical maintenance section.

At the Manor Mills works of the Hercules Cycle and Motor Co., Ltd., of Birmingham, with which this article is concerned, this section is seventeen strong, consisting of the works electrical engineer and his assistant, eight electricians, and seven mates. Bicycles are not assembled at the works, but the surprisingly large range of components which comprise them are all produced, and as this involves some shops in 24-hour working, there is always a night shift of an electrician and mate on duty.

Electricity Supply

Before we give attention to the maintenance system operated at the works, it is necessary to consider the electricity supply provided and the layout of the works. Manor Mills is a 4-storey building, and the main electricity supply is taken into a transformer substation on the ground floor, adjacent to the electrical workshop. The supply is taken from the Midlands Electricity Board at 11 kV, and transformed down in this substation to 400/230 V, three-phase and in the others to 400 V.

Four transformers are installed in the main substation: 1 x 750 kVA, 2 x 700 kVA and, for lighting, 1 x 500 kVA. All the h.v. gear is by George Ellison: three incoming panels are the property of the M.E.B., all other equipment being owned by Hercules. The transformers are conventionally installed in shingle filled pits with an oil barrier around them. Cables run in ducting beneath the floor to two rows of 400 V Ellison switchgear, arranged on two bus-bars, one behind the other. The front bus-bar is sectionalised by a bus coupler. The lighting supply does not come through this switchboard, but is taken off from its transformer via a Brush panel equipped with h.r.c. fuses.

Two features of the electrical installation which are repeated throughout the work are apparent in the main substation. The first of these concerns lettering. Each 400 V switch is marked with the number of the transformer whose supply it controls, or with the description of the floor panel which it feeds. This chain of marking is continued throughout the installation to distribution boards and electrically driven machines.

The other feature that stands out is the extensive installation of power factor correction capacitors. This has been in operation since 1935 on a manually switched basis, and is at present being extended and converted to automatic switching (using a M.V. control panel). In the eighteen or so years experience of using large static capacitors, there has been very little trouble. Most of what has occurred has involved overheating of the infrequently operated controlling contactors.

Altogether, there are 23 capacitors installed around the works, in 75 and 63 kVA ratings. They total 1·6 MVA, and partly account for the excellent power factor of 0·94 at which the works takes its 2·06 MW maximum demand.

The remaining two substations are situated on the second floor, fed radially from the main substation 11 kV bus-bars through a ring main cubicle. In the first, two transformers are installed, 250 and 300 kVA rating, supplying respectively welding sets and a 290 h.p. dust extraction plant. The other has a single transformer, this being a 300 kVA automatic tap changing unit feeding the main rectifier units.

Secondary Distribution

Ducts from the main substation come into an area, and from this two sets of main risers of 0·3 sq in. copper section are taken up the walls. The cables are paper insulated, lead covered, wire armoured, present practice being to install a non-bleeding design: it is considered that the extra margin of safety this gives is well worth the extra cost involved.

At each floor, the rising cable is made off into a floor switch-board having 160 amp h.r.c. fuses, and feeding in turn distribution and subdistribution boards equipped with 60, 30 and 15 amp h.r.c. fuses respectively. Each floor board has associated with it an appropriate number of p.f. correction capacitors which will in due course be switched automatically from the panel in the main substation.

Distribution from the floor boards is normally by v.r.i. cables in steel conduit. Lighting circuits are taken from a separate riser, which feeds t.p.& n. h.r.c. fuse boards. These in turn feed d.p. rewirable fuseboards, and d.p. switches, each of which controls six lights. These lighting switches are grouped beneath their appropriate power distribution boards.

Each distribution board is duly lettered —say F—to correspond with floor board circuits, and individual machines are then indicated as F1, F2, F3, etc.

Machines are usually fed by v.r.i. cables in conduit, run on the ceiling and dropped down to each machine. The local sub-distribution boards have rewirable fuses rated at 15 amps, and the minimum size of cable used is 3/·036. There is a case for overhead bus-bars in some shops, but circumstances have prevented the adoption of such an arrangement.

Individual Shops

On the ground floor an auxiliary plating section operates and there are heat treatment furnaces. Bright plating is performed, the vat having a capacity of 80 racks of work/hour, and operating on an automatic conveyor system. It gives little trouble except as far as the controlling contactors are concerned. These are oil immersed units which control 1 h.p. motors. It is necessary to inspect the control panel in which the contactors are housed monthly, and quite frequently to change the contacts. Limit switches on the conveyor associated with the bright plating vat are of the spring-loaded snap-action type.

Overhead cranes used in connection with another vat give a certain amount of trouble, especially with respect to their brakes, and interlocks. The latter suffer from the severe jarring they experience, and small defects are accentuated by the difficulty of gaining access to the cranes, which are in continuous use. So long as the cranes are working, however, there is no trouble with the crane wires due to fumes from the vats; the contact trolleys have a self-cleaning action.

On the same floor there is an extensive machine tool installation which includes some German automatic machines of particular interest. Operation is all-electric, with a mercury reservoir device to prevent continued running of the motors if a mechanical fault occurs such as breakage of a drill or tap. The rotors of the motors move longitudinally to drive in and retract the tools, and because of the amount of oil and swarf around, the motors are forced-air ventilated. For this purpose a separate fan is provided, drawing air through a filter.

A single high speed contactor, rated at 60 amps, controls the machine, protec-

tion for each of the motors being provided by a separate thermal overload trip which operates on this main contactor. The operation of these trips caused a certain amount of trouble originally, as they were enclosed within the contactor cover with no external reset button. Separate buttons for each motor have now been installed by the electrical maintenance section.

Twin-tube fluorescent lighting fittings are installed in this shop, giving 16 ft candles at the machines.

There is an extensive press shop, with motors driving through belts. Lighting on the presses is at 12/25 V, local step-down transformers being provided.

In the general machine shop, one notable problem is presented by the solenoid-operated valves fitted to some machines. With frequent operation it is found that the laminations spread out at the ends and eventually break. Shading rings can be a problem too, often proving insufficiently strong to stand up to the mechanical strain.

Welding machines are fed through switchfuses from the 250 kVA transformer which have already been mentioned. From the maintenance point of view, most trouble is caused by the controlling contactors. The welders operate at a high repetition rate, and in these conditions the silver contactor contacts tend to pit and open circuit.

Platings and Preparations

One of the most difficult shops to maintain is that housing the mopping plant. An extensive dust extraction plant is installed, but in spite of this plant maintenance conditions are naturally not ideal. Electric motors are of the totally enclosed, fan cooled type, and are installed in the base of the machines they drive. Since the machines are heavily loaded, bearing trouble is not uncommon, and this often indicates itself by operation of the motor overload trip. A certain amount of trouble is experienced due to motor starter thermal units failing after operators have made repeated attempts to restart the motors following an overload trip, without allowing reasonable time for cooling. The usual practice in such cases is to renew the whole of the starter interior.

As mentioned earlier, the main plating shop has its own substation and this supplies a total low voltage d.c. load of some 31,000 amps. Selenium rectifiers (Westinghouse) are fed through a Ferranti moving coil regulator and 400/18 V step-down transformers. Additional voltage control is provided by the main 11 kV/400 V transformer feeding this substation, for it is provided with automatic tap changing gear operating over a range of eleven 2½% steps.

The rectifiers are standard 1,000 and 2,000 amp selenium oil-cooled units. The apparently obvious device of replacing a single row of rectifier plates when trouble occurs is not considered practicable, as a new row of plates usually upsets the load-sharing properties of the rectifier sections.

Heavy-section bare copper strip busbars are used to connect the substation to the main plating vat. In assembly, the surfaces to be clamped together are first thoroughly cleaned, and then they are lubricated, the facing joints being immediately clamped together Where adverse conditions are experienced, the mating surfaces are first tinned, sweated together and painted with anti-sulphuric paint.

There are two main vats, one nickel and one chrome, the total length of the complete units being 265 ft.

They are automatic, conveyor fed and temperature controlled, this latter by means of thermostatically operated hot and cold water valves. Controls are centralised on a single main panel. A current feed is provided at both ends of the vat, to ensure that there is an effective current flow in the electrolyte at every point. The articles to be plated hang from fly bars each of which supports seven racks. These slide along a phosphor bronze rail running the length of the vat, which provides the current feed to the work. The rail is lubricated with graphite once a week.

Maintenance Principles

The electrical maintenance staff at Manor Mills tackle all the electrical work involved in the factory including the routine maintenance of the 11 kV substation gear and the care of the many temperature sensitive instruments used in the heat-treatment, and plating sections—with one exception. It is not considered worth while to employ an armature winder to deal with the relatively few burnouts experienced, and so arrangements to cover this work have been made with a local specialist firm.

Routine maintenance in the substation is of necessity a job for the holidays, when the works are closed down. However, an effective inspection system is in operation and the substations are frequently cleaned. With this combination anything unusual is quickly noticed.

It is, of course, possible to give attention to individual cubicles in the substations at times other than holidays, if this is necessary. The T.I. Group with which the Hercules Co. is associated, maintains an oil filtration plant which periodically filters the transformer and switchgear oil.

Medium voltage circuit-breakers are again usually attended to at holidays, or in cases of urgency, at night. Oil in dashpots is changed periodically, and whenever there is cause to open-up a breaker, contacts are inspected.

Motors are in every case induction machines except for Ward-Leonard machines on a planer. They are inspected as and when electricians are working in the appropriate shops, which may give an interval of one to three months. The most frequent trouble experienced is with oil, which penetrates into the stator and softens the end windings. Totally enclosed fan cooled motors are being specified for all newly purchased machines as the best way of dealing with this trouble.

Relatively little trouble has been experienced with single-phasing, due to some extent to the insistence that overload trips should always be installed on at least two phases, and in general on all three. Where single-phasing has occurred, it has been traced to contactors sticking in on one phase.

Motors are direct-on-line started in ratings up to 5 h.p. Above this, star-delta starters or slip-ring motors are used. Contactors cause trouble with some machines, due to speed of operation, which may reach 600 makes/hour. In general, trouble with control gear arises from penetration into equipment of oil and water, access being commonly obtained through push-button openings.

On the subject of motor control gear in machine tools, it is felt strongly that no machine should be sent out by its manufacturer without an isolator being fitted. Another shortcoming experienced too often is protection by fuses only, with no overload trips. As not unusual, there is a feeling that motors driving suds-pumps are one of the most troublesome items.

Details of all equipment are recorded on cards kept in the maintenance workshop. These note all leading spare numbers, dimensions, drawing and makers' numbers, and list the various locations in which the machine or equipment is installed during its life. On the back of the card is space for brief details of all repairs and adaptations made, together with the cost of these.

Control gear for the welding machines, which has already been mentioned, is electronic and electromagnetic. Contacts give some trouble as stated, and the problem is to ensure that the timing is exact with all poles of the relay. Levelling up can be attempted, but the best practice particularly if pitting has started, is to change all the contacts.

Maintenance of the lighting installation is in the first place—cleaning—carried out by a labourer who is going round all the time. Lamps are replaced when they fail, and no regular illumination level measurements are taken. Low voltage local lighting on machines is normally used, portable inspection lights are provided with a step-down transformer in a box, and are plugged into special 230 V socket-outlets, which are provided on a minimum scale of six per shop.

Considerable attention is given to earthing. Periodical loop testing is carried out to check the value of resistance, and it is endeavoured to maintain this below 0·5 ohm in many cases. The main earth is a series of cast-iron pipes sunk into the ground, and all other earth points (such as the neutral points in the two smaller substations) are bonded back to this main earth.

The earth continuity conductors of portable tools are given a test at monthly intervals with a G.E.C. set which passes a heavy current through the conductor.

Our thanks are due to the directors of Hercules Cycle and Motor Co., Ltd., and to Mr J. H. Asdell, of T.I. (Group Services) Ltd., for permission to publish this article and for help in preparing it.

Planning a Works Distribution System

Part 2 Switchgear Arrangements

by a Steelworks Electrical Engineer

IN an earlier article* the problems of the choice of the most economical voltage and cable size were considered. The selection and arrangement of switchgear is a closely allied problem. Before looking into questions of types of gear and bus-bar arrangements, a few general principles will be discussed.

Security of Supply

The degree of supply security required and the permissible shut-down times which can be allowed will materially affect the pattern of a works electrical system. Any degree of security can be provided at a cost, and it is the duty of the works electrical engineer to tread the narrow path of compromise between a cheap installation when the outage of a single cable or switch will shut down a portion of the plant, and the operator's ideal which will offer the maximum flexibility and ease of switching at, of course, much greater expense.

Carried to its logical conclusion, a supply to a particular drive can only be considered secure if duplicate motors, control gear, cabling and feeds from alternative sources are provided. Schemes as elaborate as this are sometimes adopted, for example, for the electrically driven tilting motions of large steel furnaces, when mal-operation of the drive for a few minutes may result in the loss of hundreds of pounds worth of steel and much production time. At the other extreme, it would be difficult to justify expenditure on standby supplies to a machine tool which was one of a number engaged on similar production; in such a case the cost of a stoppage would be the value of the work the machine would have turned out if still functioning. If the operation in question is not a bottleneck in the production line, the loss of output for the plant as a whole will not be serious, and can be recovered.

Many practical cases are far less clear cut than the two extremes quoted above. but decisions about the security to be offered cannot be deferred until later in the planning programme since they represent the basis for system design.

Switchgear Rating

The current carrying capacity and the rupturing capacity specify the size of a circuit-breaker; like most things in life these ratings must be paid for, and the higher either of them may be, the more costly will be the switch. Figs. 1 and 2 show the relative costs of different types of switchgear for various ratings; it will be seen that the costs rise steeply for the larger sizes and bigger rupturing capacities. If the fault level can be kept down to 75 MVA at 3·3 kV and 150 MVA at 6·6 kV an economical switchgear price will result. At 11 kV 250 MVA gear can be cheaply produced, but rupturing capacities much above the figures quoted may lead to inordinate rises in cost.

If the costs derived from these graphs are combined with those for cables, it will be realised that the conclusions indicated in the previous article are borne out when the switchgear is considered, and that an economical distribution system will not utilise many circuits with heavy current loadings, and short circuit levels will be kept reasonable.

Sectionalisation

A system of sectionalised bus-bars will have a major effect in keeping down the cost of a works electrical network. In an installation with a 3·3 kV system such as that shown in Fig. 3, 150 MVA switchgear will be required if the transformers are normally run in parallel with the section switch on the main bus-bars closed. If, however, the section switch is interlocked with the two transformer switches so that only two of the three may be closed at any one time, 75 MVA gear can be used. For the system shown this will result in a saving of about £3,000 at present day prices of switchgear, apart from any reduction which can be made in cable sizes due to the lower short circuit level (see Fig. 4, Part 1*). The obvious disadvantage of this arrangement is that failure of either of the two supplies will put half the works out of action for as long as it takes to carry out the switching necessary to restore supply to the dead bus-bar. For certain industries, where continuous processes are in use such a shut-down period cannot be tolerated, but in most works a short stoppage can be allowed; the costs of a stoppage must be weighed against the increased costs if complete continuity of supply is required.

If sectionalisation cannot be permitted due to the dangers of supply failure, there are a number of other simple expedients for reduction of the short circuit level which though costly may show a net saving when balanced against the reduced cost for lower rupturing capacity.

In the system of Fig. 3 the section switch may be replaced by a bus-section reactor, capable of carrying the load of either half of the bus-bar, as shown in Fig. 4. 100 MVA switchgear will now be

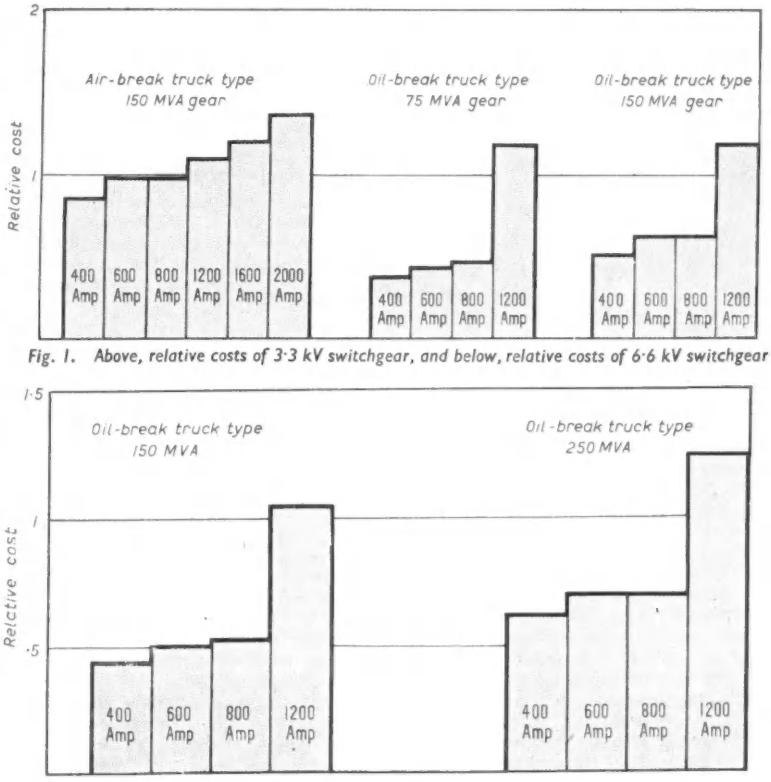


Fig. 1. Above, relative costs of 3·3 kV switchgear, and below, relative costs of 6·6 kV switchgear

* *Industrial Maintenance, page 1,* ELECTRICAL TIMES, *21 Jan., 1954.*

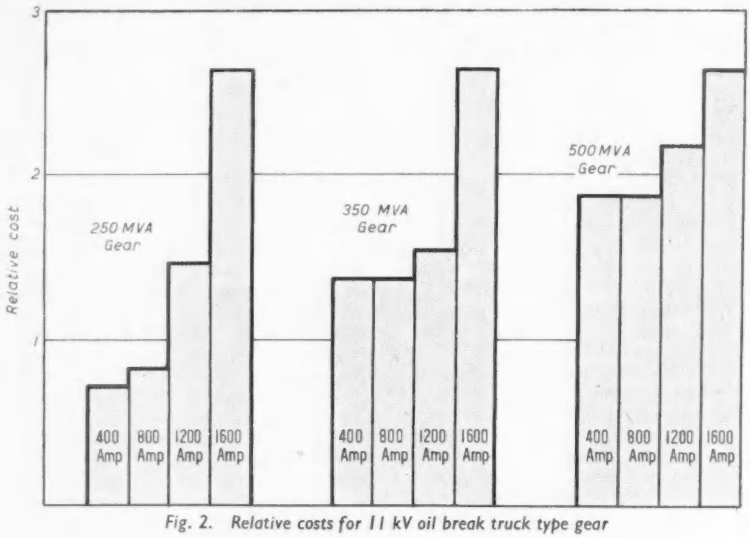


Fig. 2. Relative costs for 11 kV oil break truck type gear

adequate, but the additional costs of the reactor and an extra switch must be met. The tap range of the 7·5 MVA transformers may have to be altered and the voltage regulation of the system will be slightly worse due to the reactor.

Transformers in the range 5-30 MVA are normally manufactured to have a reactance voltage drop of 10%. The makers can, however, "build" extra reactance into the transformer to give a figure of 12% or 15%, the effect being the same as if a series reactor were placed between the transformer and the bus-bar. Again the costs will increase and the voltage regulation will be worse in order to achieve a reduction of the fault level.

A device which can be usefully adopted when one or two large blocks of power have to be fed in addition to the normal distribution is the group feeder reactor, illustrated in Fig. 5. In this example, designed to illustrate the principle, two large machines are to be fed directly at 6·6 kV, and full security of supply is required. The 6·6 kV gear on the network will be of 150 MVA rupturing capacity, and the 350 MVA gear is used on seven circuits only, at the additional expense of two reactors and three 150 MVA switches.

H.V. Network Arrangements

In works when the amount and disposition of the load justify an h.v. distribution network, appreciable savings in switchgear costs can be made if some operational inflexibility can be accepted. Certain processes will not, in fact, allow of such inflexibilities and in these cases the necessary switchgear must be provided; the works engineer should however bear in mind that ease of operation can only be gained at a cost, and that this cost must be justifiable.

If load is to be supplied at l.v. at outlying points the use of transformer feeders will eliminate an h.v. switch at the remote substation. It may be necessary to arrange intertripping facilities between the h.v. and l.v. sides of the transformer, in which case the cost of pilot cables must be offset against the savings in h.v. switchgear. Substation No. 1 in Fig. 3 is an example of this, and if the h.v. section switch is to be kept open as discussed above, the l.v. section switch in the substation should also be open in order to avoid paralleling supplies which may have a phase displacement between them. For maintenance purposes this arrangement is less convenient than one with an h.v. switch at the substation, and if this is some distance from the main h.v. board time will be lost in isolating and earthing the transformers.

When substations with one transformer only are involved the cost of an h.v. switch at the receiving end is hardly ever justified. The transformer l.v. switch may also, in certain circumstances, be omitted.

Ring main Substations

If load is to be supplied from an outlying substation at both h.v. and l.v., an h.v. bus-bar with its switchgear must be established, and these are often fed by ring main arrangements as at substations 2 and 3 of Fig. 3. Dependent on the degree of security required, economies can be effected in the use of h.v. switchgear. In the simple ring illustrated, if the network is operated "split" either or both of switches B and C will normally be open and each substation will be fed by a radial feeder from the main h.v. board. In these circumstances, there is nothing to be gained from making switches A and D automatic circuit-breakers, and they may be either off-circuit isolators or non-automatic load-breaking switches. Plain isolators introduce operational delays, since they may have to be interlocked to ensure that they are not operated alive, and the time required in switching the ring may thus be prolonged. Air-break isolators cannot usually be opened when carrying even the charging current of a cable, since the low power-factor arc drawn between the blades may produce enough ionised gas in the isolator cubicle to cause a flash over. A load breaking switch, which should be capable of making against a fault, will avoid this difficulty and provide greater flexibility. The use of a standard circuit-breaker without protective gear, automatic tripping or instrumentation will achieve the object and still save the costs of relays, c.t.'s and associated wiring; if required the switch may be made automatic at a later date. In the example shown both B and C must be automatic circuit-breakers if it is considered necessary to obtain discrimination in protective gear when the interconnector is closed and both substations are being fed from one bus-bar of the main switchboard. If the industrial process is such that the loss of both substations due to a fault on the interconnector can be faced, then all four switches A, B, C and D, may be replaced by isolators.

If security of supply is essential the system of Fig. 3 would be operated with the main section switch and all ring main switches closed; in this case A, B, C and D must all be circuit-breakers.

L.V. Arrangements

Short-circuit considerations apply to systems of all voltages, but particularly in the case of l.v. networks it is desirable to keep the fault level down. To those accustomed to dealing with h.v. switchgear, 15 MVA rupturing capacity at 400 V appears at first sight a very low figure; this will however involve fault currents of over 21,000 amp, about twice the maximum to be expected on the British 132 kV grid system. The use of large blocks of l.v. power is, therefore, to be avoided whenever possible. If, for example, it is required to meet a concentrated load of 2,000 kW with a firm supply an installation of three 1,000 kVA transformers may prove more economical than an arrangement with two 2,000 kVA units. The three-unit scheme will be more expensive in h.v. switchgear and transformers, but if an extensive l.v. network is involved the savings resulting from the lower l.v. fault level may well outweigh the additional expenditure.

In a works h.v. network firm supplies are usually ensured by the use of ring mains and individual substations are sometimes additionally reinforced by spur feeders from the main h.v. switchgear. If this is done it is obviously uneconomical to provide l.v. interconnectors as well; frequently however some additional flexibility can be provided by having points of l.v. interconnection on the network. A good example of this occurs on belt conveyor systems, where material is passed from one section of the plant to another and appreciable total power requirements have to be met in small "packets" spread over a fairly large distance. A run of l.v. cablework along the conveyor structure is practically unavoidable, and the handling and fixing charges will not vary greatly whatever size of cable be employed. By making the main run of sufficient size to carry the whole conveying system the load may be fed from substations at either end. In

this way firm supply will be guaranteed to the conveyor and at the same time load-transfer facilities will be provided between the points of supply at each end.

D.C. Supplies

A very substantial proportion of industries in this country use all power on an a.c. system, thus avoiding the higher capital and maintenance charges associated with d.c. motors. However the torque/speed characteristic of the d.c. series machine makes it so suitable for traction and haulage duties as to justify its use when close control of heavy loads is required. The d.c. shunt or separately excited motor can give speed control over a very wide range and may be specified for this purpose in preference to an a.c. machine. The use of d.c. drives does not necessarily require the provision of a d.c. network, and such a network is to be avoided for the same reasons as those which render an extensive l.v. a.c. network are undesirable. In many cases however, the number and sizes of d.c. motors to be installed are such as to require the establishment of d.c. bus-bars, switchgear and a distribution system. If power of more than a few kW is required the conversion from a.c. to d.c. will usually be via mercury arc rectifiers and these will be fed from the h.v. system. The question of choice of voltage again arises and d.c. pressures between 200 and 500 volts are to be found in common use. The lower voltages are often preferred as offering less risk of insulation troubles, particularly with small motors and control gear where space may be restricted, but if the converting plant cannot be situated close to the load the cost of d.c. cabling may be excessive.

Oil immersed switchgear is not suitable for d.c. circuits since the arc never passes through a current zero, and there is no opportunity for the oil to establish an interrupting medium when the switch opens. High speed circuit-breakers, where the operating time is reduced to the minimum, may be required for the protection of mercury arc rectifiers.

Switchgear Considerations

The works engineer is faced with the choice of a multiplicity of types of switchgear for all voltages; it is not intended in this article to "re-hash" manufacturers' catalogues in discussing the detailed merits or demerits of particular forms of construction, and only general comments will be made.

Reference has already been made to some factors which affect the rupturing capacity of switchgear. In determining the current-carrying capacity of switches it is generally desirable to specify a rating rather higher than that of the circuits which they control. This is not because switches are incapable of carrying continuously their rated current, but because of their very low overhead capacity. Cables transformers and machines can carry heavy overloads for short periods of time without danger of overheating, provided that the conditions before and after the overload are favourable. In comparison with such plant, switchgear has a very low thermal capacity due to the smaller masses of metal used and in consequence the time taken to reach dangerous temperatures is much less. Although there may appear to be no immediate likelihood of using the emergency short time overload capacity of a feeder, it is not prudent to throw this capacity away by rating the switch strictly on the basis of the full load current of the circuit.

The cost of switchgear is high, and many engineers must have commented on the fact that a l.v. air break switch of 25 MVA rupturing capacity is considerably more expensive than a popular 10 h.p. motor car. When mass production methods are employed the cost of a finished article is largely made up of the direct charges, i.e. raw materials, labour and factory expenses. There is still a strong tendency for switchgear to be made on a "one off" or at best on a batch production basis, and it is the engineering and drawing office charges involved which add to the cost of production to make the total price as high as it is. The enormous divergence of opinion amongst engineers as to what are desirable features is one of the reasons why switchgear is not mass produced, and even the batch production at present in force may be seriously impeded by the insistence of engineers on the provision of special features which are outside the standard range of the manufacturer's products. It is not suggested that these requests represent individual fads, or are made with no justification, but it is a fact that costs and deliveries will be adversely affected if special finishes, special interlocking facilities, extra instrumentation or special isolating link arrangements are specified.

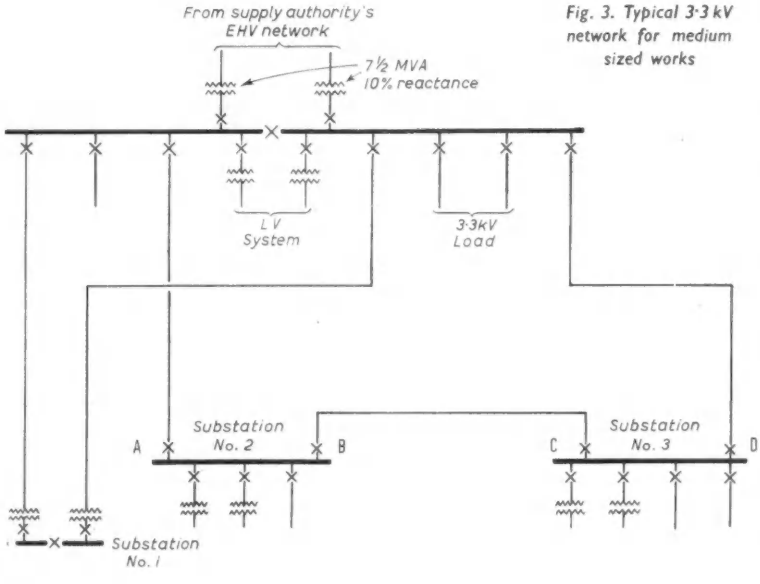


Fig. 3. Typical 3·3 kV network for medium sized works

Instrumentation

Much instrumentation is specified because "it may be useful to have that reading"; when only occasional checks of certain quantities are required the cost of the gear will be reduced if test terminal blocks are provided to which portable instruments can be connected when necessary. Thus nothing is to be gained by fitting power factor indicators in installations where there is no synchronous plant, static condensers or other means of adjusting the power factor of the circuit. kWh metering, particularly on h.v. switchgear where current and potential transformers will be required, should be installed only when the works' costing system demands a reading of energy used. Apart from kWh metering it is suggested that for most applications on outgoing feeder switches an ammeter in one phase will be adequate. For main incoming feeder switches voltage, current and power indication will usually be justified, with power factor indication dependent on the plant installed and the nature of the supply authority's tariff. Bus section and bus coupler switches may be non-automatic circuit-breakers without protective gear or instrumentation of any kind.

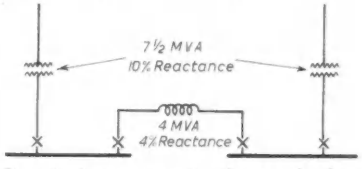


Fig. 4. Re-arrangement of main bus-bars seen in Fig. 3.

Interlocking

The question of interlocking merits special consideration apart from its effect on the cost of switchgear. Mechanical and electrical interlocks are fitted to guard against such mal-operations as the racking out of a closed circuit-breaker or the closing of an alternator switch with the synchronising circuit de-energised. The key system of interlocks is

much used for items of plant which are physically separated, and very elaborate schemes are in use which make mal-operation practically impossible. Cubicle type switchgear, for example, may be arranged so that the bus-bar isolator cannot be operated with the circuit-breaker closed, the circuit-breaker chamber access doors cannot be opened unless the gear is isolated from both cable and bus-bars and is earthed, and so on.

The two dangers which attend any scheme of interlocking are that it may not permit operation under emergency conditions, and that it may be so intricate as to require special training of the staff and involve considerable operational delays. In either case there will be found a strong tendency for the operators to "cheat" the interlocks, particularly by making a master key for a key system, and thus invalidate the whole principle. Continental practice appears to be based on the assumption that operators are not suicidally-minded, and tends to avoid mechanical interlocking schemes almost entirely. Whilst it is not suggested that

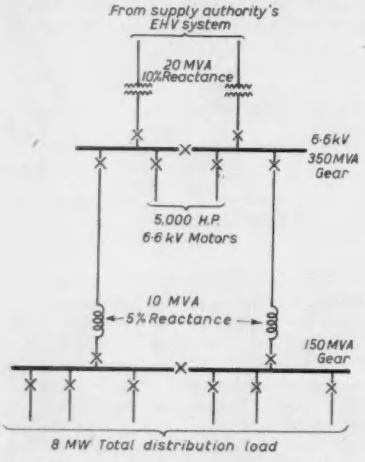


Fig. 5. Distribution system using group feeder reactor method

British practice should follow similar lines, it is emphasised that an interlocking scheme which may in certain circumstances have to be cheated engenders a false sense of security, and in the result may do more harm than a system which relies on the intelligence and proper instruction of the operators.

Bus-bars and Insulation

The various types of bus-bar enclosure and switch arrangements which are produced in this country have, in the majority of cases, been developed at the instigation of power station and distribution authorities. In these applications the function of the process is the generation and supply of electrical energy and any features which will improve the reliability of switchgear are worthy of investigation. In general industrial work, however, the electrical system is only ancillary to the production process and expenditure on the more elaborate forms of switchgear is not always an economic proposition.

Horizontal draw-out metal-clad h.v. gear with solidly compounded bus-bars is a peculiarly British development and offers the maximum security for the bus-bar insulation. The weakness lies in the joints between switch chambers, which must be compounded on site and so are not subject to the strict control of the factory-filled chamber. One or two disastrous breakdowns of this type of gear have occurred, but many thousands of units are in operation and the construction gives the highest degree of security.

For most works applications air insulated bus-bars for voltages up to 11 kV will usually meet the requirements, unless the gear is to be located in a very dusty or corrosive atmosphere. Even in these circumstances it may prove preferable to pressurise the substation with an air filtration plant, rather than face the expense of solidly-compounded metal-clad gear.

Double bus-bar switchgear can hardly ever be justified for works installations unless special operational features are involved. When, for example, private generating plant is run out of parallel with the supply authority's network the use of double bus gear will provide the maximum flexibility in transferring load from one supply to another, and at the same time economise in building space. Whilst for some maintenance purposes the provision of a "hospital" bus-bar offers advantages it is difficult to make a case for the additional cost since complete continuity of supply is not essential in most industries, and if bus-bar maintenance work must be carried out a shut-down can usually be arranged.

Solidly-compounded current transformer chambers are sometimes offered with certain classes of gear. Whilst these offer the same advantages as solidly compounded bus-bars they may prove an embarrassment in the event of a c.t. failure, or if it is found necessary at a later date to change the c.t.'s for units of a different ratio. Air or oil-insulated c.t.'s are more preferable in this respect, and when the ratio permits a choice, bar primaries are preferable to wound-primary units.

Bus-bar v.t.'s should be avoided where possible since they represent a point of hazard which may lower the integrity of the system of bus-bar insulation. It should be remembered that the h.v. fuses usually provided with v.t.'s are intended to protect the system, and not the transformer, from the effects of failure of the transformer winding. Wherever possible voltage indications should be taken from the outgoing side of switches, to provide a more reliable installation.

Switchgear Insulation

For the voltages generally to be found in works, h.v. switchgear of the oil-filled type with some form of arc-control device is extensively used. A fairly recent development is air break switchgear which at present is manufactured in this country for voltages up to 3·3 kV, though switches of this type are in use on the Continent on 15 kV services. The obvious advantages of reduction of fire risk and ease of access for maintenance purposes may be worth paying for, but here again attention must be paid to the atmospheric conditions in which the gear is to work.

Air blast switchgear should only be considered when unusually arduous duties are to be covered, as for example in the control of electric arc furnaces, where heavy overloads and partial short circuits have frequently to be cleared.

Air break switchgear for l.v. services is much used, and here the price advantage of oil-break gear is less marked than at the higher voltages. Ease of maintenance is the outstanding feature and represents a very real advantage.

Fusegear

H.V. fusegear is being increasingly used in rural distribution networks and standard ring main units in different classes of gear are now being manufactured with some or all of the switches replaced by fuses. Whether this type of gear, which is of course much cheaper than its circuit breaker counterpart, is to be used for works installation is a question which can only be solved by considering the necessity for security of supply and avoidance of longer shut-down times to restore supply after a fault.

At lower voltages high rupturing capacity fuses, particularly in the larger current-carrying sizes, have practically superseded the re-wireable fuse and in many cases are used in lieu of automatic circuit-breakers. The fact that the performance of the fuse under fault or overload conditions can be accurately predicted makes discriminative protection possible, and most works engineers will agree that the difficulty of replacing an existing fuse by one of a larger rating is a distinct advantage.

Conclusions

These notes on switchgear and its applications have very largely consisted of broad generalisations, but will, it is hoped, still prove of some value to those who have to plan and specify industrial installations. The higher the degree of security and flexibility required, the more expensive will be the installation; per contra, if limited security can be accepted appreciable savings may result. The pattern of the supply system adopted will affect the entire industrial process which it serves, and it is therefore important to arrive at a satisfactory compromise between the two conflicting considerations.

The first article in this series on planning a works distribution system dealt with the selection of distribution voltages and with the choice of cable sizes, types and runs. The present article is to be succeeded by one which discusses at some length the types of protection gear which are suitable for industrial installation, together with their selection and the routine testing and mainenance procedures appropriate to them.

(To be continued)

ELECTRIC SUPPLY NEWS

Belfast

THE latest move in the power plant contract upheaval has caused surprise in Belfast itself it seems. A few hours after a special meeting of the Corporation last week to consider the Electricity Committee's recommendation that the Government be asked to place specific contracts on behalf of the Corporation if the latter failed to do so by 1 May, a new Electricity (Essential Supplies) Bill was presented at Stormont. Actually, the Corporation at its special meeting decided by a majority vote to ask the Government to undertake the placing of the contracts. In the Bill the chairman of the Northern Ireland Joint Electricity Committee is given authority to place the contracts. But the chairman must obtain Ministry approval before entering into any contract. The aim of the Bill is to facilitate the carrying out of certain schemes under Part 2 of the 1948 Electricity Act. The unexpectedly quick tabling of this Bill leads to speculation that the Minister of Commerce may have taken note of warnings that if contracts for the plant for the new West power station are not quickly placed Northern Ireland is likely to be faced with load-shedding within the next few years. Tenders for the plant will be in the hands of the Corporation early next month, and if the Minister had decided that the contract should be placed by him, he would probably attempt to have the enabling legislation through Parliament by that date, it is reported.

Bolton

THE Town Council Planning and Estates Committee has had under consideration proposals of the B.E.A. to erect a 275 kV transmission line between Carrington down the west side of Bolton where it will link up with a similar line from Yorkshire to Preston. At an earlier informal meeting with the Authority, officials of the Council opposed the route and suggested an alternative. The Planning and Estates Committee has deferred its decision in order to allow interested people and organisations to give their views on the proposals.

Croydon

THE B.E.A. is proposing to sink a borehole at Beddington to obtain 500,000 gals of water daily for Croydon power stations. The scheme is being opposed by Surrey County Council, Carshalton, and Beddington and Wallington U.D.C's.

Glamorgan

THE possibility of the B.E.A. erecting a new power station at The Leys, Aberthaw, is still in the news. At last week's meeting of the County Council Planning Committee it was agreed to defer observations on the proposed power station until more definite proposals had been received from the Ministry of Fuel and Power or the B.E.A. It was said that definite proposals would probably be submitted by mid-summer.

Houghton-le-Spring

THE Urban Council has approved plans for a 20 kV underground cable from Herrington Burn to supply new coke works erected by the National Coal Board. The council is inquiring what progress has been made by the National Coal Board, who own the network, in providing a booster plant to improve the electricity supply in the Shiney Row area.

Norfolk

FOLLOWING a warning by Mr John A. Sumner, manager of the Norfolk subarea of the Eastern Electricity Board, that objections to river crossings by certain power lines might delay by 6 to 12 months the provision of electricity in many parts of East Norfolk, agreement has been reached in two instances. Representatives of the River Bure and Waveney Commissioners have now agreed that possible danger to yacht masts would be averted if crossings at Wroxham Bridge and Barsham gave clearance at high water level similar to that of the existing line crossing at Dunborough (it is understood to be about 60 ft). To this the Board have agreed. Earlier, at a meeting of the Norfolk and Suffolk Yachting Association, it was said that work on the line crossing the river at Wroxham has been suspended, awaiting a ruling from the M.o.T., as the Board wished to place the line at a height of 45 ft. At Herringfleet and Barsham, the River Commissioners were insisting on heights of 120 ft and 62 ft respectively. Mr. Sumner has said that one of the proposed lines is a twin 33 kV feeder from Norwich Thorpe via Wroxham to North Walsham. This is particularly urgently required to augment the supply to North Walsham and to the areas around, especially Cromer and Sheringham. The other line is also a high voltage feeder from Yarmouth to Barsham which will help to improve supplies around Lowestoft.

Sayings OF THE WEEK

"Householders should fit more than one power point to a room otherwise the house would become obsolete after four or five years," . . . A. C. OSBORNE, a London architect, speaking at a Wolverhampton conference.

"I believe electrification and not dieselisation is necessary for British Railways," . . . MR JOHN ELLIOT, chairman, London Transport Executive, speaking at Leeds last week.

"The B.E.A.'s complete immunity from criticism is causing Electricity Consultative Councils concern," . . . COMMDR. D. S. E. THOMPSON, speaking to members of the S. Eastern Gas Consultative Council.

"If it is true that some consumers have been supplied with half strength electricity and half strength gas, do the authorities propose to charge half price for the supplies?" . . . MR F. G. BOWLES, M.P. for Nuneaton, in House of Commons on 8 Feb.

Suffolk

THE need for preserving the beauty of Suffolk villages from "disfigurement" by overhead wires was urged at a meeting of the Executive of the West Suffolk Parish Council's Association. The county planning officer, Mr J. V. Gorst, agreed that the Eastern Electricity Board submitted schemes for planning observations, and inevitably they provided the shortest line between two points. Frequently that meant that some of the most attractive villages had to have o.h. lines down the village street, which brought complaints about their beauty being spoilt. Mr Gorst suggested that parish councils should be asked to report back to the Executive where there were cases of overhead wires which were evidently offensive, and where a good case could be made to report to the County Planning Committee. The latter could then make representation to the Electricity Board. But he emphasised that the last thing they wanted to do was to slow up or delay the schemes for which the villages had been waiting a long time.

Walsall

IN providing supplies to 1,600 houses on the Corporation's Mossley estate, Bloxwich, the Midlands Electricity Board has now told Walsall Corporation that it is prepared not to make any charge if the council agrees to any one of three conditions. These are that the houses be all-electric; or if the council provides 50% electric cookers and 50% gas; or if the council allows the tenants free choice between gas and electric cookers and washboilers and is prepared to equip all houses with wiring circuits for such appliances. Should the council decide to equip all the houses with gas cookers, the Board would require a contribution of £20 per house towards the cost of providing the electricity supply.

Willington

SITE work has begun on the construction of the Willington generating station, Derbyshire, for the B.E.A. The first section of the station is expected to be in operation in 1956. It is scheduled to have an installed capacity of 400 MW

made up of four 100 MW sets each served by a 830 klb/hr boiler. This station is to be one of a number of new power stations situated near the East Midlands coalfields which will feed electricity into the 275 kV supergrid.

LIGHTING SCHEMES

Axminster. The Parish Council has appointed a committee to consider the question of street lighting improvements.

Camberwell. The B.C. is seeking consent of M.o.T. to a £25,296 scheme for modernising street lighting.

Jarrow. M.o.T. has approved a further sodium lighting scheme, costing £5,815, for Bede Burn Rd and Albert Rd.

Thornaby-on-Tees. The T.C. has adopted a policy of converting street lighting from gas to electricity. Trunk roads and classified roads will be dealt with first, at a cost of about £14,500.

Wigan. T.C. is making application for consent to borrow £4,160 for the conversion of street lighting in part of Whelley, and £3,187 for street lighting on Norley Hall and Worsley Mesnes housing estates.

COMPANY ACTIVITIES

LT.-COL LORD DUDLEY G. GORDON leaves no stone unturned to make the affairs of J. and E. Hall clear to the shareholders. Even in his preliminary statement it can be seen that the dividend, increased from 12½% to 15%, is extremely well covered. Earnings in fact were equal to 71%. The preliminary statement even includes a balance sheet, as well as the profit figures. It is a model for public companies. Manufactures include the production of refrigeration machinery and the manufacture of lifts and escalators. U.K. and foreign shipping concerns are the largest customers for refrigerator plant and the majority of the ordinary capital is held by Peninsular and Oriental Steam Navigation Co.

During 1952/53 there were also considerable sales to the brewing industry, which has been making substantial additions to its bottling plant. Increasing costs and competition led to a slight fall in the company's trading profits to £529,000, a decline of £13,000. But tax was lower and in the year which ended last September, the net profits rose by £28,000 to £265,000. Still not content, the chairman has adopted revised costing methods, as a result of which the opening values of stock and work in progress were adjusted by £122,000.

The efficiency of the 1948 Companies Act vis-a-vis shareholders and directors received an apt exemplification in the case of Telephone Properties.

The company received a large sum of money from the sale of its assets. But the chairman wished to carry on the company as an Investment Trust. Shareholders objected. While various sections approached the board to revise their ideas, and pay out at least some of the money, Mr Clifford Henry Barclay put up a petition to the Chancery Division of the Courts for the compulsory winding up of the company.

This double pronged action had quick results. The company caved in and almost before steps were taken to requisition an extraordinary general meeting under the Act, the board had prepared an alternative scheme to meet shareholders' wishes. With this capitulation, the Chancery Division petition was dismissed, by consent, by Mr Justice Wynn-Parry last week.

Sir Andrew Clark for the contributory, Mr Clifford Henry Barclay, said the petition was brought under the "just and equitable" jurisdiction of the Court. He explained that the company had carried on a business in Venezuela, through a Venezuelan subsidiary, which had been acquired by the Venezuelan Government. More than £2,000,000 had been paid or was payable over a period, and the dispute arose because a number of shareholders wanted their money in cash, and the directors were proposing to carry on the company as an Investment Company.

Under the scheme put forward after the capitulation of the board, those shareholders who want cash will be given the opportunity of exchanging their shares for shares in a realisation company; others, who wished to retain interests in the company as an investment trust, would be able to do so.

Mr E. Milner Holland, Q.C., for the company, said that the shareholders who wanted to exchange shares would not be able to exchange the whole of their investments, but the greater part of them, for shares in the realisation company.—*From our City Correspondent.*

Babcock and Wilcox

The first interest payment on the £4 millions 4½% Debenture stock, 1980, will be made on 31 Mar. next, the directors state. On stock fully paid on allotment the payment will be £2. 0s. 4d. per cent, less tax. On all other stock, the payment will be £1. 14s. 7d. per cent.

J. and E. Hall Ltd.

The full accounts for the year ended 30 Sep. last show a trading profit of £531,233 after charging depreciation, etc. The corresponding figure for the previous year was £545,462. The net profit amounts to £265,233 compared with £237,462 for the preceding period. The dividend has been increased by 2½% to 15%, by the recommendation of a final 10%. During the year the company adopted revised costing methods as a result of which the opening values of stock and work in progress were adjusted by £122,000. This sum has been transferred to a reserve for contingencies.

Palestine Electric Corporation

Following on the negotiations with the Government of Israel an offer has been received which is, it is understood, for the purchase of the Ordinary and "A" Ordinary stock at 29s. 6d. per £1 stock unit.

Permali Ltd.

Dealings are expected to start today in the 2,250,000 2s. Ordinary shares of this concern, well known in the electrical industry for its specialised insulating materials. The marketing has been arranged by the Industrial Securities Co. The directors base their view on prospects on a trading profit for the year to 31 Mar. next, in the region of £70,000, on which basis the dividend would be not less than 11%, it is stated.

S. Smith and Sons (England) Ltd.

At an extraordinary meeting on 26 Feb., resolutions to effect the three-for-five scrip issue will be considered. These new shares will rank for all future dividends, but shareholders are warned not to assume that the annual rate of dividend on the larger capital will be the same as the rate last paid on the present capital.

Steel Company of Wales

The profit for this concern for the 53 weeks to 3 Oct. last is £2,082,208, as against £3,968,945 for the previous year. The reduction is largely due to increases of £765,024 and £402,887 in depreciation and interest charges. With a final dividend of 2⅔%, the total distribution for the year is again 4%.

Richard Thomas and Baldwins

The group profit for the 53 weeks ended 3 Oct. last amounts to £6,844,958 which is a reduction of £3,715,344 compared with the previous year. But after charging reduced taxation, the net balance becomes £3,131,795 (*£3,715,091*). The dividend is 13½%.

Dividends Declared

Crabtree Electrical Industries.—Interim of 7½% (same).

Hilger and Watts.—Dividend is again 7½%. Net profit for the year to Sept. 30 last is £28,634 (£28,347).

Larmuth and Bulmer.—Interim 7½% (same).

Metal Industries Ltd.—Interim of 3% (4%). The directors state that profits in the current year show a substantial reduction. Losses have been sustained by the mechanical engineering division, and earnings of certain other subsidiary companies are below last year and they do not foresee any immediate improvement.

R. H. Neal and Co.—Interim of 7½% (same) on the larger capital.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders, unless otherwise stated.

20 Feb.—Bournemouth T.C. Street lighting columns; brackets; hardwood boards; fittings and lamps.—See 4 Feb. issue.

20 Feb.—Chadderton U.D.C. Lamps in year from 1 Apr.—See 11 Feb. issue.

20 Feb.—Exeter. Lamps to all or any of 30 hospitals.—See 11 Feb. issue.

20 Feb.—Havant (Hants) U.D.C. Cables and fittings for year from 1 Apr.—See 11 Feb. issue.

20 Feb.—Higham Ferrers T.C. Street lighting in class B.—See 21 Jan. issue.

20 Feb.—Macclesfield T.C. Sodium street lighting along four roads.—Advertised in 4 Feb. issue.

22 Feb. — Bedlingtonshire. — Electrical goods during 1954-55.—See 28 Jan. issue.

22 Feb.—Northern Ireland. Installation in 160 houses at Andersontown and 43 at Ahoghill.—See 11 Feb. issue.

22 Feb.—Tynemouth T.C. Lamps and cables, fittings, etc., for year ending 31 Mar., 1953.—See 11 Feb. issue.

22 Feb.—Yiewsley and W. Drayton U.D.C. Steel street lighting columns.—See 4 Feb. issue.

23 Feb.—Durham R.D.C. Electrical goods required for housing maintenance. —See 11 Feb. issue.

23 Feb.—N. Ireland. Fittings, also electrical work, during year from 1 Apr. at Waveney Hospital, Ballymena. — See 11 Feb. issue.

24 Feb.—Clutton (Bristol) R.D.C. Installation in 20 houses at Publow.—See 4 Feb. issue.

24 Feb.—East Riding. Lamps in year from 1 Apr.—See 11 Feb. issue.

25 Feb.—Dewsbury T.C. Street lighting equipment.—Advertised in 4 Feb. issue.

26 Feb.—Belfast T.C. Chains for cranes, condenser tubes and tube plate ferrules. —Advertised in 11 Feb. issue.

26 Feb.—Carlow (Eire). Internal telephone in offices of County Council.—See 11 Feb. issue.

26 Feb.—Donegal. Installation in county hospital at Letterkenny.—See 4 Feb. issue.

26 Feb.—Manchester T.C. Electrical installation (contract 198) in 269 houses on Langley estate, Middleton. Director of Housing, Town Hall. Deposit £1. 1s.—Advertised in this issue.

26 Feb.—Westhoughton U.D.C. Lamps during year from 1 Apr.—See 11 Feb. issue.

27 Feb.—Aireborough U.D.C. Street lighting along 3 streets.—Advertised in 4 Feb. issue.

27 Feb.—Edinburgh. Electrical services for year beginning 1 Apr. at Gogarburn M.D. Instn.—See 11 Feb. issue.

27 Feb.—Horwich U.D.C. Supply of tungsten and sodium lamps in year from 1 Apr. (No tender forms issued.) T. Roscoe, clerk of council, Council offices.

27 Feb.—Irlam U.D.C. Supply of lamps during 1954-55.—See 4 Feb. issue.

27 Feb.—Merthyr Tydfil T.C. Electrical goods in year beginning 1 Apr.—See 11 Feb. issue.

27 Feb.—Midlothian. Supply and erection of thirteen 25 ft concrete columns for street lighting along Carlisle Rd. County Surveyor, 32 Palmerston Pl., Edinburgh.

27 Feb.—Weston-super-Mare. Supply of lamps in year from 1 Apr. for Hospital Management Committee, Royal West of England Convalescent Hospital, Uphill Rd.

1 Mar.—Barnsley T.C. Supply of electric lamps in year from 18 Apr. A. E. Gilfillan, town clerk, Town Hall.

1 Mar.—Birkenhead T.C. Equipment for Technical Colleges.—See 28 Jan. issue.

1 Mar.—Leeds T.C. Lamps in year ending 31 Mar., 1955.—See 11 Feb. issue.

1 Mar.—N. Ireland. Electrical installations in 48 dwellings at Keady and 40 in Randalstown. N.I. Housing Trust, 12 Hope St, Belfast. Deposit 10s. each scheme.

1 Mar.—Poplar B.C. Supply of electric lamps in year ending 31 Mar. 1955. Town Clerk, Poplar Town Hall, Bow Rd, E.3.

1 Mar.—Rowley Regis T.C. Supply of electricians' requisites in year from 1 Apr. R. Hegan, town clerk, Municipal Buildings, Old Hill, Staffs.

2 Mar.—Aberdeen. Electrical work in additions and alterations at Invernurie Academy. Architects, Tawse and Allan, 9, Bon-Accord Crescent, Aberdeen.

2 Mar.—Farnborough (Hants) U.D.C. Sewage pumps with electric motors, starters, control panels, switchgear and standby plant at Cove works.—Advertised in 11 Feb. issue.

3 Mar.—N. Ireland. Installation in Min. of Commerce Advance Factory at Dungannon.—See 11 Feb. issue.

4 Mar.—Berkshire. Supply and erection of concrete columns with sodium discharge lamps, four illuminated guard posts, switchgear and fuses, for street lighting at roundabout at Twyford crossroads. County Surveyor, Shire Hall, Reading.—Advertised in this issue.

5 Mar.—Arnold (Notts) U.D.C. Supply of tungsten, sodium and mercury lamps (tender form 4) in year from 1 Apr. Engineer and Surveyor, Arnot Hill House.

5 Mar.—Belfast T.C. Seven 220,000 lb/hr stoker fired boiler units and other plant for power station West.—Advertised in 31 Dec. issue.

5 Mar.—Belfast T.C. Feed heating and condensing plant sets; and piping, steam receivers and associated valves, electrical controls, fittings, etc.—Advertised in 7 Jan. issue.

5 Mar.—Coleraine (Londonderry). Complete new electrical installation at Coleraine Hospital for Coleraine and Portrush Management Committee. W. and M. Given, architects and engineers, 1 Waterside. Deposit £5. 5s.

5 Mar.—Co. Meath. Supply of an electrically driven pump for Nobber water supply scheme. County Engineer, County Hall, Navan.

6 Mar.—Chippenham T.C. Supply of electrical fittings. Borough Engineer, 10 Market Place.

8 Mar.—Dublin. Wiring at Dr Steevens' Hospital.—See 4 Feb. issue.

8 Mar.—Hereford T.C. Supply and installation of about 330 sodium discharge and 57 fluorescent lamps and columns along main roads. F. Margerison, City Surveyor, Town Hall. Deposit £2. 2s.—Advertised in this issue.

8 Mar.—Huntingdonshire. Electrical installation in Ramsey and St. Ives secondary modern schools. County Architect, County Buildings, Huntingdon.

8 Mar.—N. Ireland. Supply of electrical engineering materials in year from 1 Apr. for Forster Green Hospital Committee, Fortbreda, Belfast. Documents from secretary, G. E. Taylor.

10 Mar.—Leeds. Electrical works at Hull Royal Infirmary. Applications by 6 Feb.—See 28 Jan. issue.

10 Mar.—N. Ireland. Electrical installation at Erne Clothing Co.'s factory at Enniskillen. Ministry of Commerce, Chichester Hse (Room 28), Chichester St, Belfast. Deposit £3. 3s.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 117 queries answered this week

Pear-shaped rubber bell pushes suitable for use in hospitals, makers of? E.M.S. —Julius Sax and Co., Ltd., 24 Commerce Rd, Brentford; Gent and Co., Ltd., Faraday Works, Leicester.

Conductive anti-static rubber hose suitable for shot blasting purposes, makers of? E.P.—Dunlop Rubber Co., Ltd., Clerkenwell Green, E.C.1.

"Deren" convector heaters, address for spares? B.B.L.—V. G. Howell and Co., Ltd., Crown St, Wolverhampton.

"Harco" cable trays, makers of? M.I.E.C. —G. A. Harvey and Co. (London) Ltd., Woolwich Rd, S.E.7.

"Hawke" cable glands, makers of? A.W.L.—H. Dunning and Co. (1946), Ltd., Stamford Works, Stamford Rd, Audenshaw, Manchester.

"Rosie Lea" household products, makers of? T.B.C.—Rosielea Tableware Ltd., 436 Victoria Rd, Aston, Birmingham 6.

"AEM" motor starters, makers of? T.E. —Airedale Electrical and Mfg. Co., Ltd., Harrogate Rd, Apperley Bridge, Bradford.

"Panilax" insulation, makers of? Micanite and Insulators Co., Ltd., Blackhorse Lane, E.17.

11 Mar.—Carlow (Eire). Supply and installation of duplicate electrically driven pumping plant at Orchard Bridge, nr. Leighlinbridge. Consulting engineer, Pierce P. F. Purcell, "Ashton," Killiney, Co. Dublin. Deposit £5. 5s.

12 Mar.—Southend-on-Sea T.C. Installation of P.I.L.C. underground main and street lighting fittings at Connaught Hse, Rochford. Borough Architect, 30 Alexandra St. Deposit £2.—Advertised in this issue.

13 Mar.—Airdrie T.C. Lamps during year from 16 May.—See 11 Feb. issue.

13 Mar.—Dublin. Horizontal centrifugal high lift and low lift pumps.—See 11 Feb. issue.

15 Mar.—East Riding. Installation of electrical services in Brough county secondary school. County Architect, County Hall, Beverley.

24 Mar.—Ilford T.C. Pumps, motors and other equipment for sewage at pumping station.—Advertised in 4 Feb. issue.

26 Mar.—Belfast T.C. Two sets of central evaporating plant for power station West.—Advertised in 28 Jan. issue.

No date stated—Jarrow T.C. Electrical materials for housing during year from 1 Apr.—See 11 Feb. issue.

No date stated—Fleetwood. Electrical rewiring with fittings for Mount Rd church. E. C. Wright, 95 Agnew Rd.

No date stated—Haddington T.C. Electrical installation in 15 blocks (38 houses) on Roodlands site. Apply first to John McVie, town clerk.

No date stated.—N. of Scotland H.E. Board. Construction of 33 kV o.h. lines; supply and laying of 33 kV cables for reconstruction of 11 kV distribution lines between Fort William and Loch Ailort. Kennedy and Donkin, 12 Caxton St, London, S.W.1. Deposit £2. 2s.—Advertised in this issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Road, W.C.1, quoting reference.*

16 Mar.—U.S.A. Two 67,368 kVA generators, etc., for Chief Joseph Dam, for Seattle district of the U.S. Army Corps of Engineers. B.o.T. Ref. ESB/3366/54*.

17 Mar.—Australia. Supply and testing of one 120 kW, 440 V. alternator, with exciter, for State Electricity Commission of Queensland. B.o.T. Ref. ESB/3304/54.*

18 Mar.—India. Various types of electric cables and cords for Directorate General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. Ref. ESB/3147/54.*

16 Mar.—New Zealand. Two 22 MVA 110/33 kV transformer banks, and spare units for Bombay and Maimgatapere substations, for State Hydro-Electric Dept., Wellington, N.Z. Contract No. 251.

26 Mar.—New Zealand. Supply of 11 kV and 33 kV switchgear for Waitemata Electric Power Board, 81 Albert St, Auckland. B.o.T. (Ref.: ESB 1863/54).*

30 Mar.—Canada. One 30 MW steam turbo-generator exciter, feed water heating plant, condensing plant and auxiliaries; for Saskatchewan Power Corporation, Regina. B.o.T. Ref. ESB/1862/54.*

30 Mar.—New Zealand. Supply and delivery of 226 galvanised steel line towers for the State Hydro-Electric Dept., Wellington, N.2. Contract No. 262.

19 Apr.—India. Three feeder control panels, two power house auxiliaries transformer control panels, and one interconnecting panel, for Godhra Electricity Co., Bhavnagar. B.o.T. Ref. ESB/3463/54.

21 Apr.—Australia. One outdoor arc-suppression coil, 38,100 V., 50-100 A., for State Electricity Commission of Queensland. B.o.T. Ref. ESB/2692/54.*

28 Apr.—Australia. Two 7,500 kVA, 62/11 kV step down transformers for State Electricity Commission of Queensland. B.o.T. Ref. ESB/3106/54.

11 June.—Australia. Arc suppression coils for 66 kV system for Capricornia Regional Electricity Board. Specification can be inspected at 409/410 Strand, London, W.C.2.

11 June—New Zealand. Waitemata Electric Power Board invite tenders for supply of three 10 MVA and five 7·5 MVA double-wound transformers. Board is at 81 Albert St, Auckland. B.o.T. (Ref.: ESB 1862/54).*

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 16 February

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	235	+6	285
„ (3 months)	216½	+2½	—
LEAD, refined pig, min. 99·97% purity (cash)	82½	−½	93½
„ (3 months)	81½	−¼	91 5/16
TIN, refined, min. 99·75% purity (settlement)	627½	−32½	956
„ (3 months)	645	+9	939½
ALUMINIUM, ingots 99-99·5%	156	—	166
ZINC, virgin, min. 98% purity (cash)	71⅜	−2½	80⅜
„ (3 months)	70½	−1¼	80⅛
RUBBER No. 1, RSS. spot (per lb.)	16⅝d.	+⅛d.	22⅛d.
„ c.i.f. basis, ports. Apr. (per lb.)	16½d.	−1/16d.	22⅛d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	51½	—	51½
Mild Steel Tape (0·014 in.)	40	—	39½

Contracts Placed

Birkenhead T.C. Electrical installation in Benton primary school, F. Hancock Ltd., £2,053.

March U.D.C. Electrical installation at Westwood junior school, W. Palmer and Son (March) Ltd, £1,698.

Newport (Salop) U.D.C. Street lighting on Wolverhampton-Whitchurch Rd, Revo Electric Co., Ltd., £2,262.

Northamptonshire. Provision of control gear, motor starters, etc. for Pitsford pumping stations of Mid-Northants Water Board, Watford Electric Co., Ltd., £18,501.

Plymouth T.C. Laying cable for River Tavy (Lopwell) scheme, Scottish Cables Ltd., £4,599.

Southampton T.C. Electrical work in Foundry Lane school. R. F. Webb, Ltd., £1,058. Installation in civil defence main control centre, Newport Electrics (Southampton) Ltd., £1,486.

Swindon T.C. Supply and erection of concrete columns for street lighting scheme, Erecon Ltd., £1,466.

Warrington T.C. Rewiring of Town Hall, Cohen Bros. (Electrical) Ltd., £1,290.

Gazette Announcements

COMPANIES ACTS

Etherington and Partners Ltd. David Morgan, of 100 Park St, Grosvenor Sq, W.1, has been appointed liquidator with committee of inspection.

W. S. Webb and Sons, Ltd. Meetings of creditors and contributors will take place at Inveresk Hse., Strand, W.C.2, on 23 Feb. at 2.30 p.m. and 3 p.m. resp.

George Douglass and Co., Ltd. Liquidater, R. F. Howe, Official Receiver of Gibb Chambers, 54 Westgate Rd, Newcastle-on-Tyne, released as from 2 Feb.

A. S. Blackman (Precision Engineers) Ltd. Meetings of creditors and contributories at Inveresk House, Strand, W.C.2, on 19 Feb. at 11.30 a.m., and 12 noon, respectively.

Voluntary Liquidation

Electrical Power Specialists (Hendon) Ltd. Liabilities of £3,416 were shown in statement of affairs submitted to statutory meeting of creditors. Assets scheduled at £2,307, leaving a deficiency of £1,109 as regards creditors. Issued share capital was shown at £4,500 and, so far as contributories were concerned, there was a total deficiency of £5,609. A resolution passed for appointment of A. W. Hunter, of Latham and Co., 418/422 Strand, W.C.2, as liquidator, with committee of inspection.

BANKRUPTCY ACTS

Release of Trustees

Plymouth. Reginald D. Nichols trading as Eagle Electrical Engineering Co. at 9 Friary St, Plymouth. Trustee was F. B. Goodman, Official Receiver of 24 Lockyer St, Plymouth.

Portmadoc. Hugh J. O. Evans, electrical engineer trading at High St, Harlech. Trustee was E. S. Browne, C.A., 41 North John St, Liverpool.

BUSINESS PROSPECTS

Home

Antrim. N. Ireland Hospitals Authority has approved in principle sundry additional buildings at both Holywell and Carrickfergus Hospitals.

Armagh. Building of a hospital at Portadown and admission unit at St. Luke's Hospital approved in principle by N.I. Hospitals Authority.

Barking T.C. It is proposed to develop Thames view estate, contract 3, comprising 206 houses and 76 flats.

Belfast. It is proposed to erect an eye, ear, nose and throat hospital in Springfield Rd.

Bermondsey B.C. Scheme in hand for erection of 77 flats in Roymouth Rd.

Biggleswade (Beds) R.D.C. It is proposed to erect total of 50 dwellings on five sites, largest being 14 at Clifton.

Birmingham T.C. Approval sought for 148 shops, 500 garages and 12 tenants' meeting rooms on various estates at cost of about £1,186,562; and also establishment of R.C. (Special Agreement) modern school in City Rd area at estimated cost of £225,700.

Blaby (Leics) R.D.C. Erection of houses costing £120,000 proposed for 1954.

Bradford. Associated Weavers Ltd., carpet makers, to add a further storey to their works at cost of £16,804.

Burnley T.C. Scheme approved for rewiring Municipal College at estimated cost of £7,000.

Buxton T.C. Tenders will probably be invited soon for erection of 77 houses on Victoria Park (No. 3) site.

Caernarvon. Plans submitted to T.C. by Thomas and Evans Ltd., Porth, Rhondda, for new works in Balaclava Rd.

Calne and Chippenham R.D.C. Layout plans approved for erection of 38 houses and 3 bungalows at The Tynings; and for 96 houses, 42 flats and 14 bungalows on Priory St and Married Quarters site.

Calne (Wilts) T.C. Sketch layout approved for 859 dwellings on Lickhill site. Revised plans submitted for 40 flats at Broken Cross site.

Chatham. Leonard Stace Ltd. to extend factory in Gloucester Rd.

Cheltenham. Alfred Miles Ltd. seeking permission to erect factory, workshops and offices on site in Tewkesbury Rd.

Chester T.C. New editorial offices and workrooms proposed at Printing Works, 27 Bridge St, for Chester Chronicle and Associated Newspapers Ltd.

Chorley (Lancs) R.D.C. Total of 50 houses to be built on four sites.

Dartford T.C. Erection of 86 dwellings on scheme 6 of Temple Hill Neighbourhood Unit. Borough Surveyor, Barclays Bank Chambers, High St.

East Riding. Work expected to begin in July on construction of £100,000 county secondary school at Hornsea.

Edinburgh. Permission granted to N. British Distillery Co. to build 5-storey warehouse in Westfield Rd at cost of £165,000.

Gateshead T.C. R. W. Gregory and Partners, Pilgrim Hse, Newcastle, appointed electrical consultants for new Leam Lane primary school.

Grantham (Lincs). Plans submitted to T.C. for factory premises at Gonerby Hill Foot for Grantham Precast Co., Ltd.

Greenock T.C. Approval given to erection of 73 houses, shops and flats in central area development scheme, and 273 houses at Larkfield.

Grimsby T.C. Erection of 37 houses on Grange estate and 31 on Fletcher Rd estate. J. V. Oldfield, Borough Engineer and Surveyor, Municipal offices, Town Hall Sq.

Hammersmith. Erection of factory extensions in Hythe Rd, proposed by E.N.V. Engineering Co., Ltd. at approx. cost of £50,000.

Harrogate T.C. Tenders likely to be invited for erection of 72 flatlets on Grove House and Bilton Lane estates.

Hendon. It is proposed to erect two two-storey wings and adapt other portions of buildings at technical college. Estimated cost £54,000.

Hillingdon (Middlx.). Scheme approved by N.W. Metropolitan Hospitals Board for erection of new maternity dept. at the hospital. Cost estimated at £224,000.

Hove. S.E. Metropolitan Hospital Board recommended to approve first stage of scheme to rewire Sussex Maternity Hospital. Estimated cost, £1,863.

Kirkcaldy T.C. Eight-storey block of flats, costing £86,000, to be built at Valley Gardens.

Lambeth. E. W. Banfield and Son, 28 Mortimer St, W.1, are architects for proposed £37,000 factory in Brixton Rd.

Lancashire. Site chosen and approved in Collins Rd, Bamber Bridge, for new Walton-le-Dale county secondary school.

Leamington Spa. R. W. Wilcocks, 7 The Parade, is architect for factory on Queensway Trading Estate for J. Trelawney Ltd.

Leeds. Prince's Investments Ltd. to complete block of offices in the Headrow. Estimated total cost is £500,000.

Litherland U.D.C. Application to be made to borrow £61,800 for erection of 40 houses in Hatton Hill Rd.

Luton T.C. Erection of all or some of 119 houses on Rambridge estate. Borough Engineer, Town Hall. Two blocks of College of Further Education, estimated to cost £130,000 to be included in 1955-56 programme.

Machynlleth (Mon) U.D.C. Ministry approved layout for 94 houses on Talrallt site.

Middlesbrough T.C. Plans approved for erection of 850 houses and flats on Pallister Park site.

Milford Haven (Pemb) U.D.C. Scheme approved for 54 houses at Picton Camp.

Newbury (Berks) T.C. Plans in hand for erection of 199 houses, 60 flats and block of shops on Bath Rd site.

Newcastle-under-Lyme T.C. Tenders to be invited soon for erection of 30 houses on Knulton Farm site.

Newcastle-on-Tyne. Sketch plans for proposed Kenton primary school approved.

Newcastle-on-Tyne. Courtaulds Ltd. contemplating building factory in the North-East. Tenders to be considered soon for erection of school costing £46,000 at North Fawdon; City Architect is G. Kenyon, 18 Cloth Market.

North London. Riches and Blythin, 16 Northumberland Ave, W.C.2, are architects for extension in Osman Rd, N.1, proposed by Delavelle (G.B.) Ltd.

Norwich. Min. of Works proposes building £150,000 telephone exchange to plans by architect's dept. at Abell Hse., John Islip St, S.W.1.

Norwich T.C. Layout prepared for 2,000 house Heartease estate. First development to include mixture of 696 houses and flats.

Nuneaton T.C. Revised layout in hand for 186 houses on section 6 of Camp Hill estate.

Orrell (Lancs) U.D.C. Erection of 31 houses on Kitt Green estate. Surveyor and Engineer, Council Offices, Orrell Post, nr. Wigan.

Peterborough T.C. £256 to be spent on electrical installation in garages on housing estates.

Rugby T.C. Erection of total of 180 dwellings on Abbotts Farm estate. Borough Surveyor, Burford Hse, Church Walk.

Scunthorpe. Plans in hand for second instalment of N. Lindsey Technical College, estimated to cost £127,500.

Shotley Bridge (Dur.). A. Bolton and Co. seeking site for erection of factory.

Southgate (Middlx.). Proposed Eversley junior school in Prince George Ave., expected to cost about £48,985.

Stoke Newington B.C. It is proposed to build 59 dwellings on Portland Rise estate, and 20 in Spencer Grove and Shakespeare Walk.

Stourbridge T.C. Construction of 146 dwellings on Pedmore Fields Estate and shops with flats on Wollaston Farm estate. G. N. Maynard, Borough Engineer and Surveyor, Council House.

Strabane (Tyrone) U.D.C. Approval received to plans for 108 houses in Ballycolman Ave.

Stratford-on-Avon R.D.C. Seventy houses to be built at Brearley, four at Moreton Morrell and three at Ettington.

Sunderland T.C. Schemes for mental occupation centre (£23,000), for health centre at Springwell (£50,000), and for extending Thompson Park Day Nursery (£9,500), to be included in 1954-55 programme.

Taunton T.C. Plans approved for erection of factory in Greenbrook Ter, for F. Piper and Sons (Taunton) Ltd.

Twickenham. T.C. has approved plans for erection of Methodist church in Percy Rd, Hampton.

Whittlesey U.D.C. It is proposed to erect further 40 houses.

Worcester T.C. recommended to approve layout of 1,430 dwellings on Warndon estate.

Overseas

Canada. Dr James Hendrie, City Health Dept., City Hall, Brandon, Manitoba, would like to receive quotations from U.K. manufacturers of audiometers. Local supply is 110 V 60 c/s.

India. Electric Construction and Equipment Co., Ltd., of 35 Chittaranjan Ave, Calcutta, would like to represent U.K. manufacturers of meters, generating sets, h.t. and l.t. o.c.b., and other power house equipment.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Barolite Ltd., 1518 London Rd, Norbury, S.W.16. Manufacturers of and dealers in motor car lamps, bulbs, clocks, etc. Nom. cap.: £100. Dirs.: B. Basset-Smith and A. F. W. Cook, J. Trapman and F. Pollard.

Bushell and Saward Ltd., 52-4 High Holborn, W.C.1. Manufacturers and importers of and dealers in lampshades, electrical fittings, novelties, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subscribers. Subs.: J. A. Bushell, 2 Craven Gdns, Barkingside, Essex; and W. C. Wiles, 51 Morley Rd, Chadwell Heath.

Colne Electric Ltd., 3 and 5 Station Rd, The Parade, Watford. Designers, manufacturers, fitters, maintainers and repairers of and dealers in transformers, converters, dynamos, etc. Nom. cap.: £15,000. Dirs.: R. E. Beeson and E. H. Stoner.

Cook and Co. (Euston) Ltd., 101 Hampstead Rd, N.W.1. Electrical engineers and contractors, etc. Nom. cap.: £2,000. Dirs.: A. J. Harvey and Mrs G. A. Harvey.

Delabee Ltd. General, mechanical and electrical engineers, etc. Nom. cap.: £1,000. Dirs.: L. S. Delapena and Mrs B. M. Delapena, 2 Suffolk Sq, Cheltenham; Ivy Trenchard, H. Longley and A. R. O. Slater.

John S. Hall Ltd., 81/3 Cliff Rd, Canal St, Nottingham. Refrigeration, mechanical, electrical and radio engineers, etc. Nom. cap.: £1,000. Dirs.: J. S. Hall and Mrs H. Hall.

Lampitts (Wolverton) Ltd., 8 Stratford Rd, Wolverton, Bucks. To take over business of electrical and radio engineers, contractors and suppliers carried on at Wolverton and Stony Stratford, Bucks, by Martin J. Gunstone. Nom. cap.: £5,000. Dirs.: M. J. Gunstone and Doris J. Gunstone.

Page's of Barkingside Ltd., 3 Broadway Parade, Fencepiece Rd, Barkingside. Manufacturers of and dealers in electrical goods, wireless and television sets, etc. Nom. cap.: £500. Dirs.: D. F. W. Page and J. H. Fenn.

Trade Notes

In view of increased activity in Northern Ireland, and in order to strengthen their position in that territory, Philips Electrical Ltd. have raised their depot at Belfast to the status of a branch. The former depot manager, Mr R. Winsby, has been appointed branch manager.

Beama Contract Price Adjustment Formulæ.—*For Electrical Machinery and Equipment.* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 13 Feb., 1954, shall be deemed to be 141s. 6d.; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry published in the Board of Trade Journal on 13 Feb., 1954, is 156·3.

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 13 Feb., 1954, shall be deemed to be 141s. 6d.; (*b*) "Cost of Material"—the index figures published in the Board of Trade Journal on 13 Feb., 1954, are: Materials used in Mechanical Engineering Industries—147·1; "Blast Furnaces and Iron and Steel Melting and Rolling (40 and 41)"—143·1. The price of brass condenser tubes, ¾ in. o/d, 18 s.w.g. publisher in *The Metal Bulletin* on 12 Feb., 1954, is 3s. 4¾d. per lb.

For outstanding Contracts covered by the B.O.T. Intermediate Products Index. For purposes of calculating variations in (*a*) "Rates of pay"—the rate of pay for adult male labour at 13 Feb., 1954, shall be deemed to be 141s. 6d.; (*b*) "Cost of Material"—the index figure for Intermediate Products published in the Board of Trade Journal on 13 Feb., 1954, is 350·5.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Duraglas. 725,025. Class 17. Heat, sound and electrical insulating materials etc. Turner Bros. Asbestos Co., Ltd., 77/79 Fountain St, Manchester 1.

Exelvick, 725,139; **Castlvick,** 725,142; **Duravick,** 725,143; **Corvick,** 725,144; and **Molvick,** 725,145. Class 9. Electric arc welding apparatus, etc. Metropolitan-Vickers Electrical Co., Ltd., St. Paul's Corner, 1/3 St. Paul's Churchyard, E.C.4.

Peribraid. 723,360. Class 17. Electrical insulating sleeving etc. Suflex Ltd., 35 Baker St, W.1.

Plaster Master. 724,167. Class 9. Electrical apparatus. S. O. Bowker Ltd., 19/21 Warstone La, Birmingham 18.

MEETINGS TO NOTE

THURSDAY, 18 FEB.

INCORP. PLANT ENGINEERS (Blackburn).—"Fire Protection for Industrial Buildings," A. Jackson. Grosvenor Hotel, Lord St, 7.30 p.m.

I.E.E. (London Utilisation).—"Electronic Motor Control," A. O. Dalton; "Arc-Quenching Circuits," B. T. Stonehouse, "Survey of the Principles of the Contact Rectifier," D. R. Smith. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (E. Midland).—"Overhead Distribution," H. W. Grimmitt. George Hotel, Kettering, 7.30 p.m.

I.E.E. (Southern).—Faraday lecture on "Electro-Heat and Prosperity," O. W. Humphreys. Guildhall, Southampton, 6.30 p.m.

I.E.E. (Irish).—"Physics of Nuclear Energy Release," Prof E. T. S. Walton. Trinity College, Dublin, 6 p.m.

A.S.E.E. (Kent).—Lecture at Bridge Cafe, 32 High St, Tonbridge, 8 p.m.

FRIDAY, 19 FEB.

I.E.E. (N. Staffs).—"Modern Review of Fundamental Electromagnetic Theory," P. Hammond. Duncan Hall, Stone, 7 p.m.

ELECT. TRADES COMMERCIAL TRAVELLERS' ASSOC.—Annual luncheon at Connaught Rooms, W.C.2, 12.15 p.m.

I.E.E. (N. Ireland).—Dinner-dance at Grand Central Hotel, Belfast, 7.30 p.m.

MONDAY, 22 FEB.

I.E.S. (Leeds).—"Fashion and Creative Photography in Advertising," J. Short. Lighting Service Bureau, Aire St, 6.15 p.m.

I.E.S. (Leicester).—"Light, Colour and the Stage," A. G. H. Tuxford. Elect. Offices, Charles St, 7.30 p.m.

INSTN. OF WORKS MANAGERS (Glasgow).—"Steam Utilisation and Fuel Efficiency," J. Edward. 39 Elmbank Cres, 7.15 p.m.

I.E.E. (London Radio).—Discussion on "Acceptable Standards of Quality in Sound Broadcast Transmission and Reception," J. K. Webb. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N. Eastern).—"Co-ordination of Insulation of H.V. Electrical Installations," J. S. Cliff. Neville Hall, Westgate Rd, Newcastle, 6.15 p.m.

I.E.E. (S. Midland Radio).—"What is an Amplifier?" D. A. Bell. James Watt Memorial Inst., Great Charles St, Birmingham, 6 p.m.

I.E.E. (Western Utilisation).—"Application to Industry of Radio Active Isotopes," J. L. Putman. Elect. Offices, Colston Ave, Bristol, 7 p.m.

I.E.E. (Irish).—Annual conversazione and dance at Gresham Hotel, Dublin, 9 p.m.

TUESDAY, 23 FEB.

COVENTRY ELECTRIC CLUB.—"Clocks, Ancient and Modern," A. W. Marshall.

ENGRS. GUILD (W. Midland).—"Impact of Information on Industry," K. J. Ryder. Imperial Hotel, Birmingham, 6.30 p.m.

BRIT. INSTN. OF RADIO ENGINEERS (W. Midland).—Paper by J. McFarlane at Wolverhampton and Staffs Tech. College, Wulfruna St, Wolverhampton, 7.15 p.m.

I.E.E. (London Measurements and Supply).—"Applications of the Electrolytic Tank to Engineering Design Problems," H. Diggle and E. R. Hartill. Savoy Place, 5.30 p.m.

I.E.E. (N.W. Measurements).—Discussion on "Influence of Legislation on Costs of Metering," S. Howarth. Engineers Club, Albert Sq, Manchester, 6.15 p.m.

A.S.E.E. (Coventry). — "Contemporary Trends in TV," G. B. Townsend. Technical College, 7.15 p.m.

WEDNESDAY, 24 FEB.

E.A.W.—Annual meeting at 35 Grosvenor Place, followed by luncheon at 42 Belgrave Sq, S.W.1.

I.E.E. (London Supply).—"Transport, Preparation and Utilisation of Colliery Tailings at Emile Huchet Power Station," Prof R. Gibrat and F. Chenin. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Southern).—"Technical Arrangements for Sound and TV Broadcasts of Coronation," W. S. Procter, M. J. L. Pulling, and F. Williams. R.A.E. Tech. College, Farnborough, 7.30 p.m.

THURSDAY, 25 FEB.

TELEVISION SOC.—Fleming Memorial lecture on "Colour TV," G. G. Gouriet. Royal Instn., Albemarle St, W.1, 7 p.m.

INST. OF WELDING (S. London).—"Influence of Arc Welding on Modern Engineering Design," K. K. Doherty. Wandsworth Tech. College, S.W.18, 7 p.m.

I.E.E.—Annual dinner at Grosvenor Hse, Park Lane, W.1, 7 p.m.

I.E.E. (E. Midland).—"Overhead Lines," Swan St Hall, Spalding, 7.30 p.m.

I.E.E. (N. Midland).—"Ignition Interference with TV Reception," A. H. Ball and W. Nethercot. Elect. Offices, Ferensway, Hull, 7.15 p.m.

A.S.E.E. (Luton).—"Modern Applications of Fluorescent and Tungsten Lighting," D. E. Mutch. George Hotel, George St, 8 p.m.

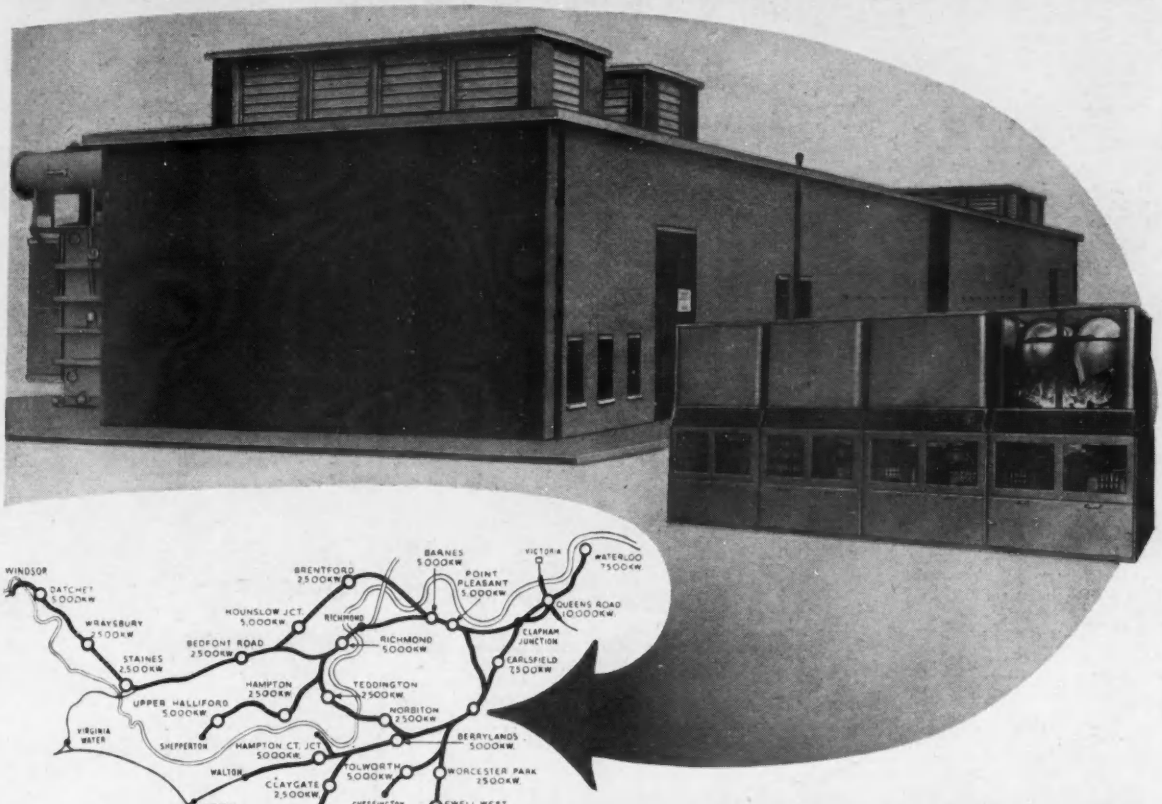
FRIDAY, 26 FEB.

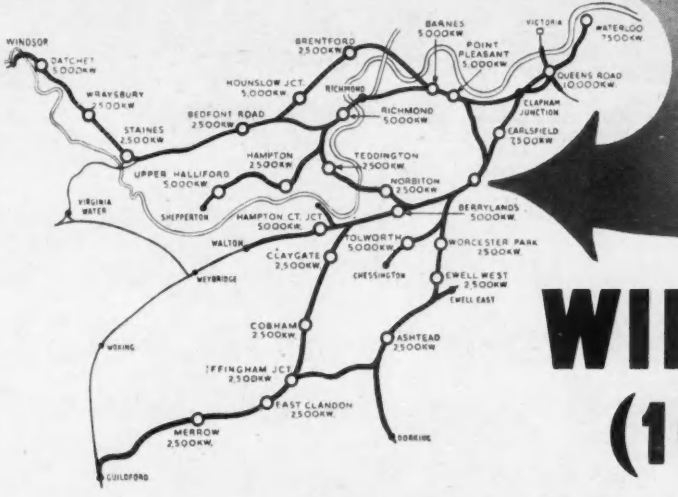
I.E.S. (Bath and Bristol).—"Black Light—Effect and Applications," R. V. Mills. Elect. Offices, Old Bridge St, Bath, 7 p.m.

I.E.S. (Birmingham).—Annual meeting. "Illuminations from Ophthalmic Standpoint," W. J. Wellwood Ferguson. Regent Hse, St. Phillip's Place, Colmore Row, 6 p.m.

N.E ELECTRIC CLUB.—Ladies' Night.

NOW COMMISSIONED





WIMBLEDON (10,000 KW.)

SECOND OF 28 HEWITTIC RECTIFIER SUBSTATIONS FOR BRITISH RAILWAYS SOUTHERN REGION

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone : Walton-on-Thames 760 (8 lines) *Telegrams : "Electric, Walton-on-Thames"*

OVERSEAS REPRESENTATIVES

ARGENTINA: H. A. Roberts & Cia., S.R.L. Buenos Aires. AUSTRALIA: Hackbridge and Hewittic Electric Co., Ltd., Sydney. BELGIUM & LUXEMBOURG: M. Dorfman, 124, Avenue des Cerisiers, Woluwé 1, Brussels. BRAZIL: Oscar G. Mors, Caixa Postal 1280, Sao Paulo. CANADA: The Northern Electric Co., Ltd., Montreal, etc. CHILE: Ingenieria Electrica S.A.C., Santiago. EAST AFRICA: Gerald Hoe & Co., Private Bag, Nairobi. EGYPT: Giacomo Cohenca Fils, S.A.E., Cairo. FINLAND: Sähkö- ja Koneliike O.Y. Hermes, P. Esplannaadikatu 37, Helsinki. HOLLAND: J. Kater E.I., Ouderkerk a.d. Amstel, Amsteldijk Noord 103c. INDIA: Steam & Mining Equipment (India), Ltd., Calcutta; Easun Engineering Co., Ltd., Madras, 1. IRAQ: J. P. Bahoshy Bros., Baghdad. MALAYA & SINGAPORE: Harper, Gilfillan and Co., Ltd., Kuala Lumpur. NEW ZEALAND: Richardson, McCabe & Co., Ltd., Wellington, etc. PAKISTAN: James Finlay & Co., Ltd., Karachi. TRINIDAD & TOBAGO: Thomas Peake & Co., Port of Spain. TURKEY: Dr. H. Salim Oker, Karanfil Sokak 59, Ankara. URUGUAY: H. A. Roberts & Cia., S.A.U., Montevideo. U.S.A.: Electro Machinery Corporation, 50, Broad St., New York, 4.

The Siemens 'Social Colour' (de luxe Warm-White) Fluorescent Lamp provides lighting which combines the *quality* of the normal 'pearl' filament lamp with the *low running costs* of the fluorescent tube. By its light, make-up, dress materials and furnishings continue to look 'right'; foods looks wholesome and appetising; everything appears just as your customers are used to seeing it. The Siemens 'Social Colour' Lamp removes the last objection to fluorescent lighting in the home. Descriptive folder sent gladly on request. Another advance by Siemens is the new Warm-White Fluorescent Lamp, which operates at an extremely high efficiency, giving increased economy for commercial and industrial lighting.

SIEMENS ELECTRIC LAMPS & SUPPLIES LTD.

38/39 UPPER THAMES STREET, LONDON, E.C.4.

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s

TENDERS INVITED

COUNTY BOROUGH OF SOUTHEND-ON-SEA
New Electrical Main

TENDERS are invited for the performance of works in connection with the new P.I.L.C. underground main and street lighting fittings at Connaught House, Rochford, and incidental works in connection therewith.

General Conditions may be inspected and copies of Form of Tender, Plans and Specification obtained on application to the Borough Architect, 30 Alexandra St, Southend-on-Sea, on payment of a deposit of £2 which will be refunded on receipt of a bona fide tender or the return of all loaned documents.

Sealed tenders addressed to the undersigned and endorsed "Connaught House—New Electrical Main" are to be delivered at this office by 12 noon on Friday, 12 Mar., 1954.

No tender will be received except in the special envelope provided, which shall not bear any name or mark indicating the sender.

The Corporation do not bind themselves to accept the lowest or any tender.

ARCHIBALD GLEN,
Town Clerk.
(G 681)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD
Morar-Fort William Reinforcement

TENDERS are invited for the construction of 33 kV overhead lines, supply and laying of 33 kV cables and the reconstruction of 11 kV distribution lines between Fort William and Loch Ailort.

Copies of the Tender Document may be obtained on application to the Engineers, Messrs Kennedy and Donkin, 12 Caxton St, London, S.W.1. Applications should be accompanied by a cheque for £2. 2s. (returnable).

The Board do not bind themselves to accept the lowest or any Tender.

W. D. D. FENTON,
Secretary.
16 Rothesay Ter,
Edinburgh 3. (G 682)

CITY OF MANCHESTER

THE Housing Committee invite tenders for the Electrical Installation work on Contract 198 for 269 Houses on the Langley Estate, Middleton, near Manchester.

Specifications, schedules and tender documents may be obtained on payment of a deposit of £1. 1s. (cheques made payable to the Corporation of Manchester and returnable on receipt of a bona fide tender and the return of the documents) from the Director of Housing, Town Hall, Manchester 2. Tenders which must be sealed in an official envelope endorsed "Electrical Installations—Langley Estate" and addressed to the Chairman of the Housing Committee, must be received at the office of the Director of Housing not later than Friday 26 Feb., 1954.

PHILIP B. DINGLE,
Town Clerk.
(G 621)

CITY OF HEREFORD
Tenders for Street Lighting—Trunk and Main Roads

TENDERS are invited for the provision, erection and putting into service of street lighting columns and lanterns on Trunk and Main Roads in the City.

The scheme allows for approximately 330 sodium discharge and 57 fluorescent lamps, of which approximately 120 will be conversion of existing gaslamps.

Specifications, Schedules and Form of Tender may be obtained from MR F. MARGERISON, A.M.I.C.E., City Surveyor, Town Hall, Hereford, on receipt of a deposit of £2. 2s. which will be returned on receipt of a bona fide tender.

Plans and Conditions of Contract may be inspected at the same office during normal office hours.

Tenders, endorsed "Street Lighting" in sealed envelopes, and bearing no name or mark to indicate the sender, must reach the undersigned not later than 9 a.m. on Monday, 8 Mar., 1954.

The Council do not bind themselves to accept the lowest or any tender.

T. B. FELTHAM,
Town Clerk.
Town Hall,
Hereford. (G 684)

BERKSHIRE COUNTY COUNCIL
Trunk Road No. 9 (A.4.)

NEW TRAFFIC ROUNDABOUT AT TWYFORD CROSS ROADS
STREET LIGHTING

TENDERS are invited for the supply, erection and putting into service of four 25 ft concrete columns with Sodium Discharge Lamps mounted thereon together with four illuminated guard posts and all switchgear and fuses.

Tender documents and particulars may be obtained from the County Surveyor, Shire Hall, Reading.

Tenders in a plain sealed envelope endorsed "Lighting—Twyford Roundabout" should be posted to reach the undersigned not later than 9 a.m. Thursday, 4 Mar., 1954.

E. R. DAVIES,
Clerk of the Council.
Shire Hall,
Reading. (G 619)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

TRINIDAD AND TOBAGO ELECTRICITY COMMISSION
APPOINTMENT OF SENIOR ASSISTANT ACCOUNTANT

APPLICATIONS are invited from Chartered, Incorporated or Certified Accountants with some experience in the Accounting and Stores branches of a modern industrial concern, preferably in an Electricity Supply Undertaking, to fill the post of Senior Assistant Accountant with

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the Trinidad and Tobago Electricity Commission. Preference will be given to applicants who are also Members of the Institute of Costs and Works Accountants.

The commencing salary is £1,045 a year, rising by £27. 10s. to £1,127. 10s. When the total sales of electricity exceed 100 million units the salary range will be £1,155 to £1,237. 10s. A cost of Living Allowance of £25 per year and a House Allowance—maximum £10. 8s. 4d. if married and £6. 5s. if single—per month are also payable. An Outfit Allowance of £60 will be granted on arrival.

The successful applicant will be required to undergo a medical examination. He will be provided with first class passages for himself, his wife and two children up to the age of 18, on appointment. Leave passages to the United Kingdom or equivalent will be provided every three years. Vacation, casual and sick leave on full pay.

General details of Trinidad's climate, income tax, etc., can be obtained from the West India Committee at 40 Norfolk St, London, W.C.2.

Applications giving full details of qualifications, experience, and personal particulars, together with two recent references, should reach the General Manager, Trinidad and Tobago Electricity Commission, P.O. Box 121, Port-of-Spain, Trinidad, B.W.I., on or before 28 Feb., 1954. (G 523)

THE EAST MIDLANDS ELECTRICITY BOARD
Appointment of Senior Service Centre Assnt.

APPLICATIONS are invited from suitably qualified persons for the post of Senior Service Centre Assistant Male, at Service Centre, High St, Rugby.

The person appointed will be required to take complete charge of the Service Centre under the District Commercial Engineer.

Candidates should have a sound knowledge of electrical domestic appliances of all kinds and be able to advise consumers on matters relating to tariffs and apparatus.

Salary and conditions of service will be in accordance with Grade 2 (£460/£520) of the National Joint Council Agreement.

Applications giving details of age, experience and qualifications, should be forwarded to The Manager, Rugby District, High St, Rugby, to reach him not later than Monday, 1 Mar. (G 620)

BRITISH ELECTRICITY AUTHORITY

REQUIRE SENIOR ASSISTANT in the Revenue Purchasing Department at London Headquarters. Candidates should possess a good general knowledge of the qualities of coal produced in the various coal fields and the present system of allocating supplies. Practical experience in the marketing branch of the coal trade would be an advantage.

Salary N.J.C., Grade 4, £610/£672 per annum, inclusive of London Allowance. Pension Scheme. Applications stating age, present salary, and giving full details of experience to D. MOFFAT, Director of Establishments, British Electricity Authority, Winsley St, London, W.1, by 1 Mar., 1954. Quote reference AE/453. (G 643)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of THIRD ASSISTANT ENGINEER in the Commercial Department, Board Headquarters, at Mucklow Hill, Halesowen, Near Birmingham.

Applicants should be conversant with technical and statistical problems affecting electricity development.

Candidates should have had a sound technical training and wide experience in electricity development.

Salary will be in accordance with Grade 5, Class AX/EX of Schedule C of the National Joint Board Salary Agreement. Commencing salary within the range of £649/£790 per annum, ultimately rising to £883 per annum.

Apply in writing within fourteen days, stating age, experience, technical qualifications, present salary and position to Secretary (reference FWC), Midlands Electricity Board, Mucklow Hill, Halesowen, Near Birmingham.

A. STEPHENS,
Secretary.
(G 675)

YORKSHIRE ELECTRICITY BOARD
Area Board Headquarters

SECOND ASSISTANT ENGINEER
DISTRIBUTION DESIGN (SUBSTATIONS) SECTION

DUTIES will include the design of indoor and outdoor primary substations operating at voltages of 33 kV and above, the selection of protective gear installations for the primary H.V. systems, the preparation of specifications and enquiries for substation plant, negotiations with manufacturers and inspection of equipment in course of manufacture.

Applicants should be Corporate Members of the Institution of Electrical Engineers and should preferably possess a University degree in electrical engineering. They should have a sound knowledge of substation requirements and have had experience of large H.V. substation construction. Specialist knowledge of H.V. switchgear or of protective gear would be an advantage.

Salary—N.J.B. Schedule C, Class AX/DX Grade 2, £834/£1,053 per annum.

THIRD ASSISTANT ENGINEERS
DISTRIBUTION DESIGN (SUBSTATIONS) SECTION

The successful applicants will be required to assist with the design of indoor and outdoor substations operating at voltages of 33 kV and above, the selection of protective gear and the preparation of specifications and enquiries for substation plant.

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers and should preferably possess a University degree in electrical engineering. They should have a good general knowledge of substation plant and have had some experience in the design or construction of large H.V. substations.

Salary—N.J.B. Schedule C, Class AX/DX Grade 5, £649/£858 per annum.

GENERAL ASSISTANT ENGINEER
DISTRIBUTION DESIGN (SUBSTATIONS) SECTION

Applicants should hold the Higher National Certificate in Electrical Engineering, or equivalent qualification, and should have a general knowledge of H.V. switchgear and transformers, together with some practical experience of their use in distribution systems. The successful applicant will be required to assist in the work of Substation Design Section.

Salary—N.J.B. Schedule C, Class AX/DX Grade 8, £501/£694 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to Deputy Secretary, Yorkshire Electricity Board, Wetherby Rd, Scarcroft, Leeds, not later than 4 Mar., 1954.

No. 2 (Huddersfield) Sub-Area

Halifax District
DISTRICT ENGINEER

Applicants should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications. They must be widely experienced in all branches of electricity distribution work covering Industrial, Urban and Rural Areas with underground and overhead systems.

Salary—N.J.B. Class G, Grade 3 £971/£1,014 per annum.

Applications, giving full details of age, qualifications and experience together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market St, Huddersfield, not later than 4 Mar., 1954.

No. 5 (Wakefield) Sub-Area

SENIOR ASSISTANT (COMMERCIAL)

Applicants should have comprehensive experience of commercial work in general, with particular reference to applications for supply, consumers' records, hire-purchase, and methods of statistical control. They must be capable of compiling reports and interpreting the commercial implications of returns of business done. A knowledge of tariff structure and of sampling methods whilst not essential is desirable.

Salary—N.J.C. Grade 6 £700/£25/£775 per annum.

Castleford District
GENERAL ASSISTANT DISTRICT ENGINEER

Applicants must have had a sound prac-

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tical training with experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Applicants must hold a current driving licence, be prepared to reside in the district and undertake standby duties.

Preference will be given to those who are Corporate Members of the Institution of Electrical Engineers or who hold equivalent qualifications.

Salary—N.J.B. Class E. Grade 11 £524/£540 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 4 Mar., 1954. (G 646)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following post:

JUNIOR ENGINEER
(Norwich Generating Station)

Salary Class F, Grade 15 £402—Grade 14 £466 per annum.

The duties of the successful applicant will include assisting in the Control Room, on shift and other operation and investigation duties. Preference will be given to applicants who have had previous experience in a Generating Station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent.

Applications stating age, qualifications and experience should be sent to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, by 6 Mar., 1954.

W. N. C. CLINCH,
Controller.
(G 647)

LONDON ELECTRICITY BOARD
Engineering Draughtsmen

APPLICATIONS are invited for positions as ENGINEERING DRAUGHTSMEN for electrical plant layout in the Drawing Office of the Chief Engineer's Department in central London.

Applicants should preferably have served an engineering apprenticeship and have had technical training. Experience in the layout of transforming plant, H.V. switchgear and cables would be an advantage.

The posts are graded under Schedule "D" of the National Joint Board agreement as Grade 6—£458/£595. 7s. per annum, inclusive of London Allowance, and the commencing salaries will be dependent upon qualifications and experience.

Application forms obtainable from Personnel Officer, 46/7 New Broad St, E.C.2, to be returned completed by 27 Feb., 1954. Please enclose addressed foolscap envelope and quote ref. V/1580/T on envelope and all correspondence. (G 592)

LONDON ELECTRICITY BOARD
Engineer (Operation and Maintenance)

APPLICATIONS are invited for the above position in the West Ham District of the North Eastern Sub-Area.

Applicants should have had a sound technical education and possess a practical experience of all branches of engineering work associated with the organisation of the distribution department, particularly in regard to substations and mains work.

The post is graded under Schedule "A" of the National Joint Board agreement as Class F, Grade 12—£532. 7s. p.a. rising to £551. 5s. p.a. or Grade 13—£491 p.a. rising to £511 p.a. These figures are inclusive of London Allowance and the commencing salary would be determined according to qualifications and experience.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2, to be returned completed by 27 Feb., 1954. Please enclose addressed envelope and quote ref. V/1710/T. on envelope and all correspondence. (G 645)

SOUTH EAST SCOTLAND ELECTRICITY BOARD
Edinburgh Sub-Area Headquarters

(1) SECOND ASSISTANT COMMERCIAL ENGINEER with wide experience in industrial and commercial load development and D.C./A.C. changeover. N.J.B. H.5—£885/£923.

(Revised advertisement—previous applications will be considered.)

(2) SECOND ASSISTANT COMMERCIAL ENGINEER to operate installation contracting department and appliance maintenance service, including repairs workshop. Preference will be given to qualified engineers with experience in the foregoing. N.J.B. H.7—£772/£802.

Applications, giving age, qualifications and full details of past experience, to SUB AREA MANAGER, Dewar Place, Edinburgh 3, within 10 days. (G 671)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (a) and Corporate Membership for posts (b) an advantage.

(a) ASSISTANT BOILER HOUSE SHIFT CHARGE ENGINEER—Barking "A" and "B" Generating Stations

Sound technical education and experience with modern Boiler House operation including Pulverised Fuel. Salary—Class M, Grade 11=£793. 16s. p.a.

(a) STATION SHIFT CONTROL ENGINEER—Grove Road Generating Station

Sound engineering training with some experience in control and operation of steam generating plant and main switchgear in modern power station. Salary—Class F, Grade 10=£605. 17s. p.a.

(a) JUNIOR ENGINEER (Shift) (Control Room)—Barking "A" and "B" Generating Stations

Sound engineering training necessary, with generating station experience.—Salary Class M, Grade 17/3=£574. 7s. p.a.

(a) ASSISTANT ENGINEER (Control Room)—Deptford East Generating Station

Candidates should have had some experience in Control Room operation. Successful applicant will be required to operate either "A" or "B" Control Room. Salary—Class J, Grade 12=£625. 16s. p.a.

(a) ASSISTANT SHIFT CHARGE ENGINEER—Bow Generating Station

Sound engineering and technical training with practical experience in operation of boiler and turbine plant in a modern generating station. Salary—Class F, Grade 9=£637. 7s. p.a.

(b) STATION CHEMIST—Bankside Generating Station

Candidates should have had considerable experience in the Chemistry of Power Station operation. The appointment will involve close attention to operating conditions of oil-fired boilers operating at 900 psi and flue-gas washing plant. They should have had experience in a modern Generating Station and have initiative, resourcefulness and personality. Salary—Class H, Grade 7=£810. 12s. p.a.

(b) THIRD ASSISTANT ENGINEER—Transmission Department

Experience required in laying, jointing and testing of underground cables up to 132 kV and also have works' experience in the design and manufacture of cables. Salary—Class AX, Grade 5, within range £681. 9s. to £829. 10s., rising to ultimate max. of £927. 3s. p.a. Applicants in reply to previous advert. will be considered and need not re-apply.

Application may be made on form obtainable from Divisional Secretary, B.E.A., London Division, Generation House, Great Portland Street, W.1, and be received within 14 days of this advertisement. (G 649)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF ENGINEERING DRAUGHTSMAN—Chief Engineer's Department, Area Board Headquarters, Manchester

APPLICANTS should have had a good technical training and drawing office experience in the electrical design, layout and detailing of indoor and outdoor substation up to and including 33,000 volts, together with the preparation of protection system schematic and wiring diagrams.

Preference given to applicants who hold the O.N.C. and/or H.N.C. in Electrical Engineering.

Salary within range £433/£567 p.a. Schedule D, Grade 6, N.J.B. Conditions.

Applications to Establishment Officer, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 27 Feb., 1954.

APPOINTMENT OF GENERAL ASSISTANT DISTRICT ENGINEER (Installation Inspection Engineer), North-West District, Eccles

Applicants should preferably have served an apprenticeship and have had experience of the following work: Inspection and testing of all classes of electrical installations; routine meter fixing procedure; office organisation in connection with installation inspection and should have a good knowledge of the appropriate Regulations including those for the electrical equipment of buildings, and have had experience in the control of workmen. Possession of H.N.C. in Electrical Engineering will be an advantage.

Salary Scale: £608/£630 p.a. Grade G.10. N.J.B. Conditions.

Applications to Sub-Area Secretary, No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493 by 27 Feb., 1954.

APPOINTMENT OF ENGINEERING DRAUGHTSMAN—Bury District

Applicants must have had a good technical training and drawing office experience and should have had experience in the preparation of drawings for some or all of the following: Switchgear layout and diagrams; substation layout and construction; overhead line design; preparation of wayleave and other plans.

Preference given to applicants holding the O.N.C. in Electrical Engineering and/or Building.

Salary within range £433/£567 p.a. Schedule D, Grade 6. N.J.B. Conditions.

Applications to Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester 3, by 27 Feb., 1954.

APPOINTMENT OF GENERAL ASSISTANT ENGINEER (Operation and Maintenance) Sub-Area Engineer's Department, Oldham

Applicants should have a sound knowledge of the operation and maintenance of substations and O/H and U/G feeders at voltages up to and including 33 kV associated with a large industrial and rural distribution system.

Graduate membership of the Institution of Electrical Engineers or exempting qualifications will be an advantage.

Salary Scale: £583/£605 p.a. Grade K.13. N.J.B. Conditions.

Applications to Sub-Area Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, by 27 Feb., 1954.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (Installations), Sub-Area Consumers' Engineer's Department, Blackburn

Applicants should have had experience in the preparation of specifications and estimates for large industrial power, lighting and heating installations, including power factor correction schemes.

Preference given to applicants who hold the H.N.C. in Electrical Engineering.

Salary Scale: £680/£706 p.a. Grade J.10. N.J.B. Conditions.

APPOINTMENT OF THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEERS, (a) Rossendale and (b) Settle Districts

Applicants should be experienced in the supervision of Service Centres and the organisation of exhibitions, demonstrations and displays. The successful candidate will assist

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the District Commercial Engineer in the domestic and commercial development of the District and in the supervision of the staff engaged on that work.

Salary Scales: Post (a) £587/£600 p.a. Grade E.9. N.J.B. Conditions; Post (b) £532/£551 p.a. Grade C.9. N.J.B. Conditions.

Applications for above posts to Sub-Area Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, by 27 Feb., 1954.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (Operation and Maintenance) Sub-Area Mains Engineer's Department, Kendal

The duties are primarily concerned with assisting in compiling and maintaining records covering system loadings and operations, operation diagrams, plant and machinery maintenance, fault records, etc. Applicants should have field experience in H.V. and M.V. distribution systems. Preference given to holders of H.N.C. in Electrical Engineering.

Salary Scale: £680/£706 p.a. Grade J.10. N.J.B. Conditions.

APPOINTMENT OF GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER, Barrow District

Applicants must have a good knowledge of estimating and supervising contract work for commercial, industrial and street lighting schemes. Experience in agriculture would be an advantage. H.N.C. standard of education is desirable.

Salary Scale: £447/£460 p.a. Grade E.13. N.J.B. Conditions.

Applications for above posts to Sub-Area Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, by 27 Feb., 1954.

APPOINTMENT OF SECOND ASSISTANT ENGINEER (System Planning) Sub-Area Technical Engineer's Department, Hazel Grove

Applicants should preferably hold the H.N.C. in Electrical Engineering or an equivalent qualification and should have had good practical experience in the construction, operation and design of underground and overhead distribution systems, including substations, for voltages up to 33 kV.

Salary Scale: £729/£758 p.a. Grade G.7. N.J.B. Conditions.

Application forms can be obtained from Sub-Area Manager, N. 7 Sub-Area, The North Western Electricity Board, Electricity Offices, Chapel St, Hazel Grove, Cheshire, and must be returned to him by 6 Mar, 1954. (G 650)

BRITISH ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for the following positions:

Boiler House Shift CHARGE ENGINEER, Earley Generating Station, Reading. S/13.497

Applicants should have had a sound technical training, and be experienced in all branches of engineering associated with the operation of pulverised fuel fired, H.P. boiler plant, and have considerable knowledge of combustion and boiler chemistry. Possession of technical qualifications admitting to corporate membership of a recognised professional institution will be a strong recommendation.

Salary N.J.B. Grade 9, Class G, £641/£667.

GENERAL ASSISTANT ENGINEER, Non-destructive Testing Section, Generation (Operation) Department. S/13.468

Applicants should have a knowledge of measurement techniques, and should preferably possess experience of electricity generating stations and have practical mechanical ability. A knowledge of electronics will be an advantage. Preference will be given to those studying for qualifications leading to membership of an appropriate professional institution.

Salary N.J.B. AX/CX, Grade 8, £501/£675.

JUNIOR ENGINEERS S/13.498

Vacancies exist for Junior Engineers at

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Cowes Generating Station, Isle of Wight (now being extended) and at other stations.

Applicants should have had an apprenticeship or practical training suitable to the industry. They should possess a sound general and technical education and preference will be given to those possessing a Higher National Certificate.

The duties of those appointed will vary, but will include as a general rule the operation and control under supervision of generating plant.

Vacancies also exist for those who wish to specialise in the maintenance of electrical and mechanical generating plant or in generating station construction work.

Salary N.J.B. £399/£556, depending on qualifications, experience and position to which appointed.

Special Application Forms, obtainable from Mr P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, must be returned by 3 Mar., 1954. (G 687)

ELECTRICAL INSPECTOR OF WORKS (TEMPORARY)

REQUIRED by the SIERRA LEONE GOVERNMENT, ELECTRICITY DEPARTMENT for 2 tours each of 18 to 24 months in the first instance. Commencing salary, etc., according to age in scale £798 rising to £1,178 a year. Gratuity at the rate of £100/£150 a year. Outfit allowance of £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for their maintenance in U.K. Liberal leave on full salary. Candidates, preferably under 40 years, must have served an apprenticeship with a large contracting firm or industrial undertaking and have had wide experience of electrical installation work, including motors and control gear of up to 100 h.p., and making installations in conduit. They must have a thorough knowledge of the I.E.E. wiring regulations. Experience in the maintenance and repair of domestic electrical apparatus (cookers, water heaters, etc.) will be an advantage. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30383/EE. (G 617)

SOUTH EASTERN ELECTRICITY BOARD
Assistant District Commercial Engineer

DORKING AND EPSOM DISTRICT

SALARY £447/£460 p.a. under N.J.B. Class E, Grade 13. Superannuable. Applicants should be suitably qualified and have a general knowledge of the work of a commercial department. Some experience of AC/DC change-over procedure would be advantage.

Applications, on forms obtainable from W. B. Hayden, M.I.E.E., District Manager, SEEBoard, 56 South St, Dorking, and giving 2 referees must be returned to him by 3 Mar., 1954. A. L. BURNELL, Secretary. (G 674)

BRITISH ELECTRICITY AUTHORITY
South Eastern Division

ASSISTANT MAINTENANCE ENGINEER (MECHANICAL)—Brighton "A" Power Station. Applicants must have had experience in the maintenance of modern high pressure turbine and boiler plant and their auxiliaries. Class H, Grade 9, £680 p.a.

ASSISTANT MAINTENANCE ENGINEER (ELECTRICAL)—Croydon "A" Power Station. Applicants must have had experience in the maintenance of alternators, E.H.T. switchgear and motors of all electrical and auxiliary plant. Class F, Grade 9, £637. 7s. p.a. incl. Lon. All.

N.J.B. Conditions of Service for both positions. Possession of Higher National Certificate and experience in the control of labour an advantage.

Written applications should be received by the STATION SUPERINTENDENT at *either* Brighton "B" Power Station, Portslade-by-Sea, Sussex, or Croydon "B" Power Station, Beddington Farm Lane, Croydon, Surrey, by 27 Feb. (G 679)

RADIO TECHNICIAN

REQUIRED as SIGNALS ASSISTANT INSPECTOR OF POLICE by NYASALAND GOVERNMENT for one tour of 2-3 years with prospect of permanency. Salary, etc., £651 rising to £1,103 a year. Commencing salary according to experience. Outfit allowance £50. Uniform allowance £10 a year. Free passages. Liberal leave on full salary. Candidates must be UNMARRIED, between 21 and 30 years of age, of good education and physique, not below 5 ft 8 in. in height, normal vision without glasses. They must have a sound knowledge of H.F. and V.H.F. fixed and mobile simplex and duplex radio telephone systems and low power petrol electric chargers and alternators. Knowledge of morse and ability to instruct trainees in radio subjects desirable. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M1/36023/EE. (G 616)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

ENGINEERING DRAUGHTSMEN (CIVIL)
CONSTRUCTION DEPARTMENT
Vacancy No. 1/54

Candidates should have experience in design and detail of reinforced concrete structures, piled and slab foundations for heavy plant, culverts, cable subways, etc., for general building construction, drainage and sanitation schemes, associated with official and administrative buildings.

The salary will be in accordance with Grade 5 (£567/£671 per annum) or Grade 6 (£433/£567 per annum) of Schedule D of the National Joint Board Agreement.

ENGINEERING DRAUGHTSMEN
(MECHANICAL)
CONSTRUCTION DEPARTMENT
Vacancy No. 2/54

Senior Draughtsmen are required in the Mechanical Section of the Construction Department at North Wilford Power Station. Candidates should have experience in one or more of the following:

(i) Design and layout of Power Station equipment, including turbo - alternators, boiler plant, coal and ash plant, and general station auxiliaries.

(ii) H.P. and L.P. steam and feed pipework. Condensing plant and feed heating systems.

(iii) Conveyor plant, coal handling systems and material handling of station auxiliary equipment.

The salary will be in accordance with the National Joint Board Agreement Grade 5 (£567/£671 per annum) and Grade 6 (£433/£567 per annum) of Schedule D according to experience.

ENGINEERING DRAUGHTSMEN
(ELECTRICAL)
CONSTRUCTION DEPARTMENT
Vacancy No. 3/54

Candidates should have experience in the preparation of layouts and diagrams for the installation of E.H.T. and L.T. Switchgear, transformers, E.H.T. and L.T. cables; knowledge of protective year systems would be an advantage.

The salary will be in accordance with the National Joint Board Agreement Grade 5 (£567/£671 per annum) and Grade 6 (£433/£567 per annum) of Schedule D according to experience.

SHIFT CHARGE ENGINEER
FREEMAN'S MEADOW POWER STATION,
LEICESTER
Vacancy No. 15/54

Applicants should have had previous experience in the operation of a large pulverised fuel fired Station and be technically qualified.

Salary will be within Class H, Grade 7 (£772/£802 per annum) of the National Joint Board Agreement.

Closing date for this appointment will be 25 Feb., 1954.

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STATION CHEMIST
DRAKELOW POWER STATION
Vacancy No. 16/54

Candidates must have experience in the analysis of coal, oil and water. Power Station experience in a responsible position is essential, preferably with high pressure and high temperature operation, the associated problems and their solutions.

Experience in control of staff is desirable.

Salary will be within Class J, Grade 7 (£817/£852 per annum) of the National Joint Board Agreement.

Closing date for this appointment will be 5 Mar., 1954.

ASSISTANT MECHANICAL MAINTENANCE ENGINEER
LEICESTER POWER STATION
Vacancy No. 17/54

Preference will be given to applicants holding the Higher National Certificate or equivalent in Mechanical Engineering, and who have had experience in maintenance work in a large generating station. P.F. equipment maintenance experience an advantage.

Salary for the appointment will be within Class H, Grade 8 (£717/£748 per annum) of the National Joint Board Agreement.

Closing date for this appointment will be 25 Feb., 1954.

ASSISTANT ENGINEER (INSTRUMENTS)
FREEMAN'S MEADOW POWER STATION,
LEICESTER
Vacancy No. 18/54

Applicants should have the Higher National Certificate or equivalent together with sound practical experience in the maintenance of instruments in a large P.F. fired generating Station.

Salary for the appointment will be within Class H, Grade 11 (£607/£628 per annum) of the National Joint Board Agreement.

Closing date for this appointment will be 25 Feb., 1954.

RESIDENT ENGINEER (CIVIL)
NORTHAMPTON POWER STATION
Vacancy No. 22/54

Preference will be given to applicants who have a degree in Civil Engineering, are Corporate Members of the Institution of Civil Engineers or possess equivalent qualifications. They should have had experience in the administration of large Civil Engineering contracts, and be able to supervise the setting out and progress of the works, which include heavy pile foundations, culverts, structural steelwork, buildings and the like.

Salary for this appointment will be within Class AX/DX, Grade 2 (£834/£1,053 per annum) of the National Joint Board Agreement.

The closing date for this appointment is 4 Mar., 1954.

The above positions will be persionable within the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
(G 677)

SOUTHERN ELECTRICITY BOARD
Assistant Engineer (General)

SOUTHAMPTON District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class F, Grade 12, Column 1 (£507 per annum). N.J.B. Conditions of Service.

Candidates should have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and distribution equipment. The appointment will involve standby duties.

The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on the standard form, obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him in envelopes suitably endorsed, not later than 5 Mar., 1954. (G 672)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Engineering Department of No. 3 Sub-Area Headquarters, Chester:

(1) THIRD ASSISTANT ENGINEER (Planning)
(2) THIRD ASSISTANT ENGINEER (Construction)

Both appointments will be made in accordance with N.J.B. J/10 (£680/£706 p.a.).

Candidates should have had a sound technical training and be in possession of at least the Higher National Certificate. In addition, candidates for post (1) must have had experience in the design, construction and maintenance of modern H.V. and M.V. distribution networks and associated equipment, and for post (2) must have had experience of the laying of H.V. and M.V. underground cables, the erection of H.V. and M.V. overhead lines, and the erection of substations and associated equipment, together with the preparation of the relevant records.

The appointments are superannuable and subject to medical examination.

Applications should be made on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate St, Chester. Closing date: Saturday, 27 Feb., 1954. (G 648)

EASTERN ELECTRICITY BOARD
Suffolk Sub-Area

SECOND ASSISTANT ENGINEER
(COMMERCIAL)

APPLICATIONS are invited for the above mentioned appointment in the Sub-Area Commercial Officer's Department, Finborough Hall, Stowmarket.

Candidates should have extensive selling experience and the successful candidate will be required to deal with all types of commercial refrigeration enquiries; prepare and submit quotations, and conduct negotiations with the users; and to supervise the installation and setting to work of the equipment. He will also be required to advise in cases of breakdown.

Salary will be in accordance with Class H, Grade 7, of the National Joint Board Salary Agreement commencing at £772. Future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter stating age, education, qualifications and experience with details of present appointment should be submitted to THE MANAGER, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket, Suffolk, within fourteen days of the appearance of this advertisement. (G 676)

COLONIAL ENGINEERING SERVICE

A LIMITED number of vacancies are available in the Colonial Service (mainly in Africa and the Far East) for PUPILS and PROBATIONERS in Civil Engineering and for PUPILS in Mechanical and Electrical Engineering (including Telecommunications).

Candidates should have passed, or hold a University degree or other qualification which exempts from, the Final Parts I and II of the examinations for Associate Membership of the Institution of Civil Engineers, or Sections A and B of the examinations of the Institutions of Mechanical or Electrical Engineers. Engineering students whose degree examinations take place later this year may apply and will, if selected, be offered appointment subject to their passing their final examinations.

Applications should reach the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith St, London, S.W.1, in writing, by 15 Mar., 1954, and should give brief details of candidate's age, qualifications and experience, quoting reference CDE 100/011. Further details supplied on request. (G 632)

BRITISH ELECTRICITY AUTHORITY
Yorkshire Division

APPLICATIONS are invited for the appointment of SECOND ASSISTANT ENGINEER (Civil) in the Generation Construction Department, Divisional Headquarters, Leeds.

Salary £834/£1,053 per annum, Class AX/DX, Grade 2, National Joint Board Agreement (Schedule "C").

Candidates should preferably be Corporate Members of the Institution of Civil Engineers and be experienced in the design and construction of heavy foundations, river works, structures in reinforced concrete and steel, and other civil engineering works.

Duties will include supervision of the laying down of ash deposits, preparation of reports on all classes of projects and claims, and the handling of technical correspondence.

Application forms obtainable from Divisional Secretary (Establishments), British Electricity Hse, St. Mary's Rd, Leeds 7, to be returned within 14 days of the appearance of this advertisement. G. A. VOWLES, Divisional Controller. (G 680)

MINISTRY OF FUEL AND POWER

MINES INSPECTORATE. The Civil Service Commissioners invite applications from men for a pensionable post in London of H.M. Deputy Principal Electrical Inspector of Mines and Quarries. Age at least 35 on 1 Dec., 1953.

Candidates must be Corporate Members of the Institution of Electrical Engineers; the possession of a degree in Electrical Engineering in addition would be an advantage. All candidates must have had, within the last five years, at least two years' practical experience in the application of electricity to mining.

Inclusive salary £1,459/£1,775. Promotion prospects.

Further particulars and application forms from the Civil Service Commission, Scientific Branch, 7th Floor, Trinidad House, Old Burlington St, London, W.1, quoting No. S4287/54. Completed applications must be returned by 25 Mar., 1954. (G 644)

SOUTH EAST SCOTLAND ELECTRICITY BOARD
Lothians Sub-Area

THIRD ASSISTANT ENGINEER required in the Planning and Technical Section at Sub-Area Headquarters, Musselburgh.

The duties include the planning and estimating of schemes, both underground and overhead, in an area consisting of urban and rural networks at voltages up to and including 33 kV. Technical education to the Higher National Certificate standard and practical experience in the construction of overhead lines and substations is desirable. N.J.B. Class G, Grade 10, £608—£630 per annum. Superannuation Scheme.

Applications by letter, stating age, education, qualifications and experience, with details of present appointment and salary should be submitted to the Sub-Area Manager, South-East Scotland Electricity Board, High St, Musselburgh, within fourteen days. (G 566)

SOUTH WEST SCOTLAND ELECTRICITY BOARD
Glasgow Sub-Area

APPLICATIONS are invited for the position of:

ENGINEERING DRAUGHTSMAN

Applicants should have experience in design and the preparation of working drawings for reinforced concrete structures and general building construction. Experience in architectural work would be an advantage.

Salary and Conditions of Service will be in accordance with the Agreement of the National Joint Board for the Electricity Supply Industry. The salary will be on Schedule D, Grade 6, of that Agreement, viz. £567 per annum.

Application forms which may be obtained from the undersigned should be returned not later than Monday, 1 Mar., 1954.

75 Waterloo St, J. CAIRNS,
Glasgow, C.2. Secretary. (G 633)

AIR MINISTRY require MECHANICAL and ELECTRICAL ENGINEERS in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation stations. Appointments in two grades (*a*) Main Grade, salary scale £1,000 to £1,320, (*b*) Assistant Grade £650 to £1,000. Starting pay according to qualifications and experience. Salaries somewhat lower in provinces. Candidates should be age 25 or over. Appointments temporary and non-pensionable but with long-term possibilities. Special allowance up to £1,300 a year according to location payable in addition to salary during overseas service. Candidates must be natural-born British subjects of natural-born British parents.

MINIMUM qualifications and experience for both grades of posts: (i) (*a*) University degree or equivalent diploma in electrical and/or mechanical engineering and at least a two-year apprenticeship or (*b*) Graduate or Corporate Membership of the Institutions of Mechanical or Electrical Engineers with appreciable electrical engineering experience and at least three years' apprenticeship and (ii) employment in responsible position for minimum of three years with well-established engineering concern providing wide experience in electrical and mechanical engineering practice.

Application forms quoting reference D1/54A from M.L. and N.S., Technical and Scientific Register (K), Almack House, King St, London, S.W.1. (G 354)

APPLICATIONS are invited by THE ENGLISH ELECTRIC CO., LTD., STAFFORD, from young engineers of Graduate or Higher National Certificate standard with experience in the preparation of control gear wiring diagrams, for training as control gear engineers on specialised schemes. Selected applicants will, where necessary, be given a short course of training and will receive full pay during this period. The positions are permanent and progressive and afford excellent opportunities. Apply quoting ref. 1245 to Dept. C.P.S., 336/7, Strand, W.C.2. (G 615)

ASSISTANT ENGINEERS experienced in the survey and construction of Overhead Transmission Lines in Scotland, mainly wood pole types, but knowledge of tower work an advantage. Give full details, age, experience, etc., to—Box No. 611, KEITH AND CO., 137 Princes St, Edinburgh. (G 658)

BENJAMIN ELECTRIC LTD., have a vacancy for a Sales Engineer to cover North-West London, West Middlesex, Oxfordshire and Berkshire. Applicants should be resident in this area and have practical industrial lighting experience—Registered Lighting Engineer **(I.E.S.)** preferred. Write giving details of age (30/35 years preferred), training and experience to: Southern Area Manager, BENJAMIN ELECTRIC LTD., Brantwood Rd, Tottenham, N.17. (G 656)

CONTRACTS ENGINEER required to handle tenders and contacts for switchgear up to and including 33 kV equipment, and thoroughly experienced in associated protective and control schemes. Knowledge of export procedure would be an advantage. Applications giving full details of past experience and salary required to be addressed to THE PERSONNEL MANAGER, South Wales Switchgear Ltd., Blackwood, Mon. (G 554)

CROMPTON PARKINSON LTD. invite applications for the post of PRODUCTION MANAGER in the Fractional Horse Power Motor Works at Doncaster.

The person appointed would be responsible for production only, Product Design and Production Methods being the responsibility of specialist departments. The appointment offers scope for advancement to Engineer familiar with modern production plant and experience of quantity production of small motors.

Good working conditions and Superannuation Scheme.

Full details of training and experience should be sent to the Chief Personnel Officer, Crompton Parkinson Ltd., Crompton House, Aldwych, London, W.C.2, and salary required should be stated. (G 623)

COUNTER ASSISTANT for Wholesalers, London, W.14 district, used to Electrical Trade. Apply with full particulars in confidence, stating age, experience and wages required to—Box No. 3275, Electrical Times. (G 608)

DRAUGHTSMAN SENIOR required for switchgear contracts work, experienced on cubicle, truck and flat back type of gear up to 11 kV, including diagram work. Apply stating age, experience, technical qualifications, and salary, to ERSKINE, HEAP AND CO., LTD., Lancashire Switchgear Works, Salford, Manchester 7. (G 655a)

DEVELOPMENT DRAUGHTSMAN required for control gear and switchgear up to 11 kV. Apply stating age, experience, technical qualifications and salary, to ERSKINE, HEAP AND CO., LTD., Lancashire Switchgear Works, Salford, Manchester 7. (G 655)

ELECTRICAL DESIGN ENGINEER capable of initiating and supervising a programme of development of flameproof switchgear and allied control and distribution equipment is required by THE ENGLISH ELECTRIC CO., LTD., at Liverpool. Good qualifications and experience of designing to meet B.S. 229 are essential. Please write giving, in confidence, full details to Dept. C.P.S. 336/7 Strand, W.C.2, quoting ref. 777B. (G 607)

ELECTRICAL ENGINEER required for Electrical Department of Works in the North-East. Should have a sound practical training, drawing office experience, a knowledge of motor control gear resistance calculations, and preferably some experience of electrical heating for industrial applications. Apply giving full details of experience, technical qualifications, age, whether married or single and salary required, to—Box No. 3265, Electrical Times. (G 580)

EXPERIENCED TRANSFORMER DRAUGHTSMAN required for progressive Company in Manchester area. Must be able to work on own initiative on transformers up to 1,000 kVA, 33 K.V. Progressive post.—Box No. 3313, Electrical Times. (G 627)

ELECTRICIAN required for installation work on electrical equipment associated with Furnaces and ancillary equipment in Steelworks and Glassworks. Good salary, pension scheme, interesting job calling for liaison with customers electrical staff. Must be prepared to travel and should have had experience of A.C. and D.C. motors and control schemes from F.H.P. to 200 h.p. Apply by letter with details of age, experience, etc., endorsing envelope "Electrician," Stein and Atkinson Ltd., Parnell House, 25 Wilton Rd, London, S.W.1. (G 583)

ELECTRICAL DESIGNERS and DRAUGHTSMEN required permanently. Experience in Lighting and Power Installations for Schools, Hospitals and other large institutions. Five-day week. Excellent prospects. Interview expenses refunded. Confidential Applications to E. G. Phillips, Son and Norfolk, Consulting Engineers, Arskus House, Annesley Grove, Nottingham. (G 609)

ELECTRICAL DRAUGHTSMEN with good experience in cable, power and lighting installation layouts for heavy industrial works. Salaries in accordance with experience and ability. Staff Profit Sharing Scheme and Pension Fund after twelve months' service. Canteen facilities available. Apply, stating age and full particulars of experience in chronological order to: The Chief Engineer, The Associated Portland Cement Manufacturers Ltd., Portland House, Tothill St, Westminster, London, S.W.1. (G 576)

INDUSTRIAL MOTOR SALES ENGINEER is required in the London area by THE ENGLISH ELECTRIC CO., LTD. Applicants must have experience of this type of work. Write giving full details in confidence, quoting ref. 477E to Dept. C.P.S. 336/7 Strand, W.C.2. (G 579)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

ELECTRICAL ENGINEER to be responsible for electrical and mechanical design of Overhead Line Insulators. Training will be given as necessary. The post is superannuable and offers opportunities for promotion. Degree in Electrical Engineering is an essential qualification and a recognised apprenticeship with a large industrial manufacturer desirable. Age 23/30. Salary according to age, experience and qualifications. Replies to the Chief Personnel Officer, Pilkington Brothers Limited, St. Helens, Lancashire. (G 637)

FOREMAN required by Midlands firm of Contractors with experience in laying of L.T. and H.T. cables and construction of Overhead Lines. Applications with copies of references to Box 3285. (G 629)

JUNIOR ELECTRICAL ENGINEER required for Design and Development, F.H.P. motors for aircraft fuel system accessories. Main qualifications Higher National Certificate Electrical Engineering. Practical experience of winding and diagnosis of motors desirable but not essential. Write, stating age, training and salary required, to Self-Priming Pump and Engineering Co., Ltd., Trading Estate Slough, Bucks. (G 561)

LINESMEN. Experience up to 33 kV O.H. Lines.
ELECTRICIANS. Experienced in power and lighting installation.
CABLE JOINTERS. Experienced in joining main cables.

Required for service in British West Africa. Good pay, free accommodation, excellent prospects and permanent position for the right men. Must be capable of taking charge of contracts and controlling local labour. Apply giving full details of previous experience, age and whether married or single.—Box No. 3295, Electrical Times. (G 639)

LEADING STEAM TURBINE MANUFACTURER requires several experienced SENIOR SALES ENGINEERS to handle estimates and tenders for home and export inquiries. Applications, stating age, experience and qualifications to—Box 3273, Electrical Times, quoting ref. DJD. (G 606)

MECHANICAL DRAUGHTSMAN wanted for factory in West Midlands. Permanent and pensionable post, attractive working conditions. Experience of design of malleable castings an advantage. Apply giving particulars of age, qualifications and experience to—Box No. 3281. (G 618)

M.K. ELECTRIC LTD. require a REPRESENTATIVE for the Eastern Counties. Applicants, who should be car owners, must have first-rate contacts throughout the area. Apply in strict confidence to Sales Manager, M.K. Electric Ltd., Wakefield St, London, N.18. (G 624)

INTERVIEWS ARE OFFERED TO DRAUGHTSMEN
living in the London Area by

THE ENGLISH ELECTRIC CO., LTD.

at 336 STRAND, W.C.2.

on SATURDAY 20 and 27 Feb.

between 9 and 12 noon

These interviews will be without obligation and will be in confidence.

Any draughtsman with reasonable experience of Aircraft, mechanical, electrical or radio engineering is invited to call.

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ORDER CLERK required for Electrical Wholesalers, Hammersmith district, able to answer the telephone and enter orders, must have knowledge of the Trade. Reply in confidence, stating age, experience and wages required to—Box No. 3283. (G 628)

OVERHEAD Line Site Engineers, ASSISTANTS, and SURVEYORS required by Contractor for Wood Pole Construction Work in Scotland. Reply giving full particulars of experience and qualifications, which will be treated in confidence. —Box No. 3261, Electrical Times. (G 577)

PROTECTIVE RELAY DEVELOPMENT ENGINEERS required by large Midlands electrical firm. Good salary and opportunity for advancement. Air-conditioned building, modern equipment. Please write giving full details and quoting reference ABDI to—Box No. 3297, Electrical Times. (G 640)

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REPRESENTATIVE of outstanding ability required for North Western Postal Districts by a leading electrical engineering Company. Applications will only be considered from experienced men with a connection in the lamp and electrical industry. Write with full details of age, experience, qualifications and salary required to Box 7401, c/o CHARLES BARKER and Sons Ltd., 31 Budge Row, London, E.C.4. (G 631)

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SALES REPRESENTATIVE required resident in the East Midlands Electricity Board Area to call upon Service Centres and Wholesalers. Good salary and prospects for man age 25/35, of good education and appearance. Submit full personal details to Burco Ltd., Rosegrove, Burnley. (G 589)

SURVEYOR required, conversant with Surveying and Profiling Overhead Line Routes. Good wages and subsistence paid. Inverness, Elgin Area. Apply: B. French Ltd., Pike Mills, Green St, Kidderminster. (G 547)

TECHNICAL ASSISTANTS. Vacancies occur for graduated Electrical/Mechanical Engineers, to undertake interesting development work in a progressive Company, with a large programme of expansion and long term development. The posts offer considerable scope covering several branches of interesting technology, and for the gaining of a wide industrial experience. Apprenticeship and design or development experience would be advantageous, and salary will be paid according to merit. Apply—Box No. 3291, Electrical Times. (G 636)

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TECHNICAL ASSISTANTS. Vacancies occur for graduated Electrical/Mechanical Engineers to undertake interesting development work in a progressive Company, with a large programme of expansion and long term development. The posts offer considerable scope covering several branches of interesting technology, and for the gaining of wide industrial experience. Apprenticeship and design or development experience would be advantageous, and salary will be paid according to merit. Apply.—Box No. 3301, Electrical Times. (G 652)

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(2) ASSISTANT BRANCH MANAGERS. Qualified Electrical Engineers. Commercial experience desirable. Salary £700 to £850 according to qualifications.

These appointments will be for the London, East Midlands and South Wales Areas, and are pensionable. Send full details in confidence to Staff Officer, The Telegraph Construction and Maintenance Co., Ltd., Telcon Works, Greenwich, S.E.10. (G 654)

TRANSFORMER DRAUGHTSMEN wanted by firm in N.E. London. Experience on units up to 1,500 kVA essential. Good prospects for suitable men. Apply, stating age, experience and salary, to—Box No. 3309, Electrical Times. (G 685)

THE National Boiler and General Insurance Co., Ltd., St. Mary's Parsonage, Manchester 3, require ENGINEERS for appointment as Inspecting Engineers of (*a*) Boilers and Engines, (*b*) Lifts and Cranes, and (*c*) Electrical Plant. First-class M.o.T. Certificate of Competency, and/or Higher National Certificate (Mechanical or Electrical), full apprenticeship and practical experience necessary. Apply in own handwriting giving age (limits 26 to 33), training and experience, academic qualifications and copies of testimonials. Salary £540/£785 (progressive). Non-contributory pension scheme. (G 611)

TECHNICAL WRITERS are required to prepare instruction books and descriptive bulletins by THE ENGLISH ELECTRIC CO., LTD., Stafford. Applicants should be engineers having at least O.N.C. (electrical) experience of technical writing and an interest in rolling mill electrical equipment of the application of relays to protective schemes. Apply, quoting Ref. No. 1250, to Dept. C.P.S., 336/7 Strand, W.C.2. (G 642)

YOUNG ELECTRICAL ENGINEER required to assist with preparation and supervision of all light and heavy electrical work associated with furnaces and auxiliary equipment for steel and glass works. Basic knowledge of A.C. and D.C. motors and control schemes. Prepared to travel. Progressive and interesting job. Pension scheme. Apply, stating salary required, details of age, experience, etc., and endorsing envelope "Assistant Electrical Engineer," Stein and Atkinson Ltd., Parnell House, 25 Wilton Rd, London, S.W.1. (G 582)

YOUNG ENGINEERS with at least O.N.C. and practical manufacturing experience are required by THE ENGLISH ELECTRIC CO., LTD., Stafford, for estimating work on control gear related to rolling mill drivers. Write quoting reference 1199A, to department C.P.S., 336/7 Strand, W.C.2. (G 641)

YOUNG ELECTRICAL ENGINEER. Required for British West Africa to assist the Chief Engineer in preparation of specifications and estimates for transmission lines and electrical installations, and to give general supervision on contract work. Remuneration approx. £1,000 p.a. Pension scheme, free accommodation, good leave with free passages. Apply giving full details of previous experience and whether married or single.—Box No. 3293, Electrical Times. (G 638)

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Grams: Lektropowa, Hyde, London (G12p)

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THE proprietor of British Patent No. 614,373, entitled Improvements in Electric dry batteries, offers same for licence or otherwise to ensure its practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, Chrysler Building, New York 17, N.Y., U.S.A. (G 622)

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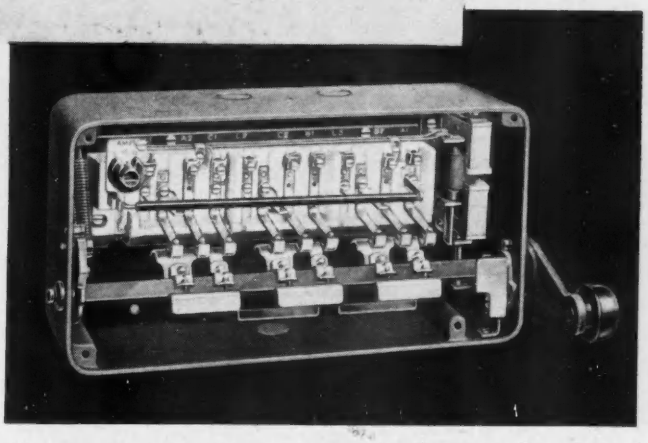

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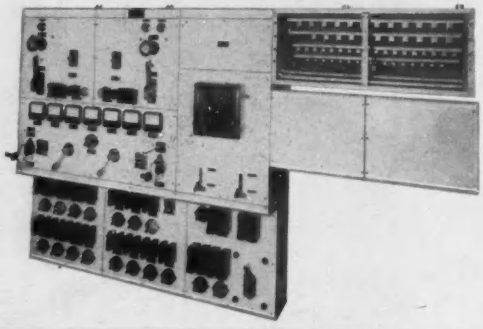

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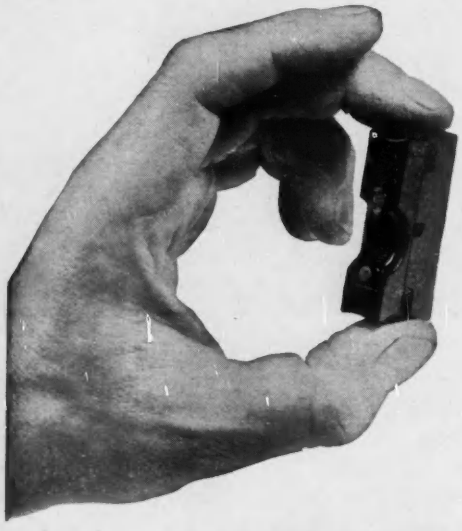

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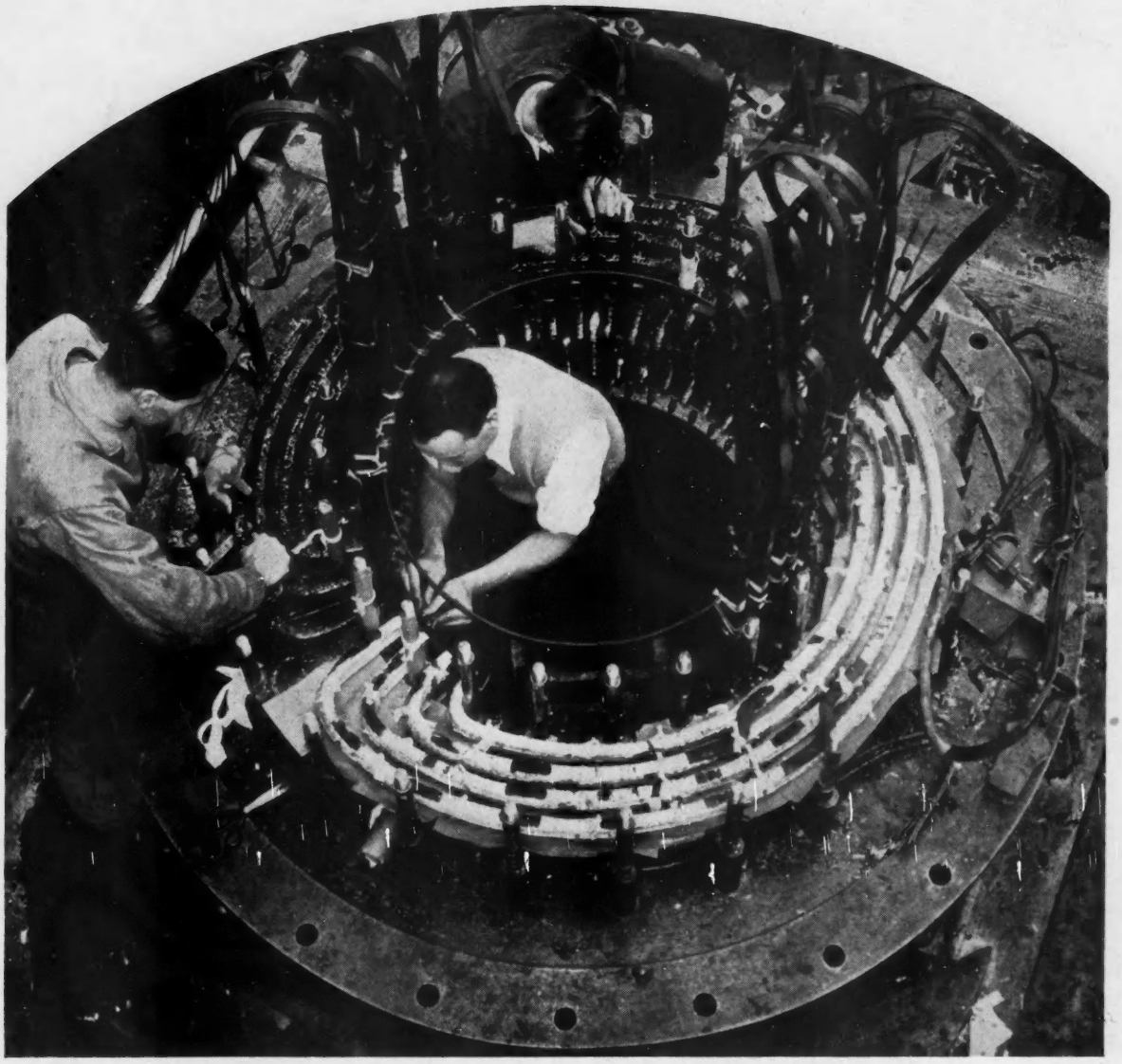

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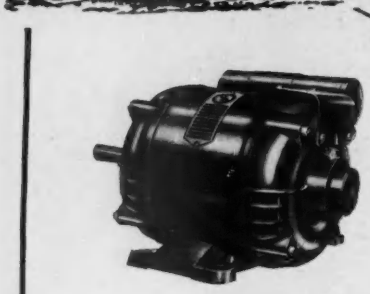

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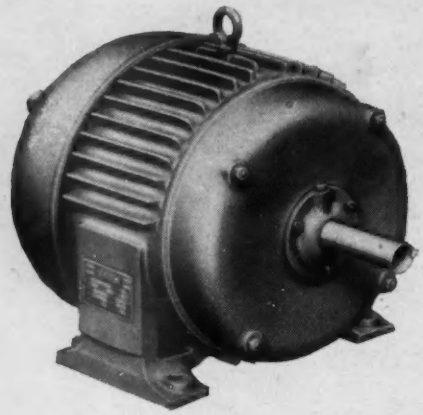

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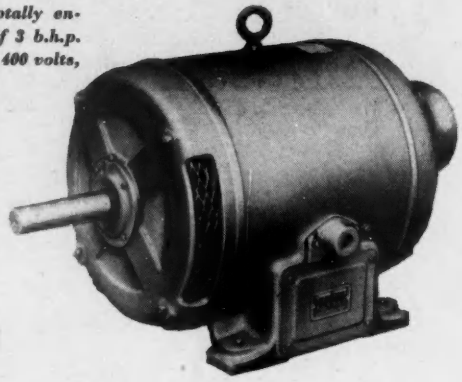

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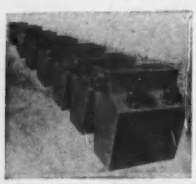

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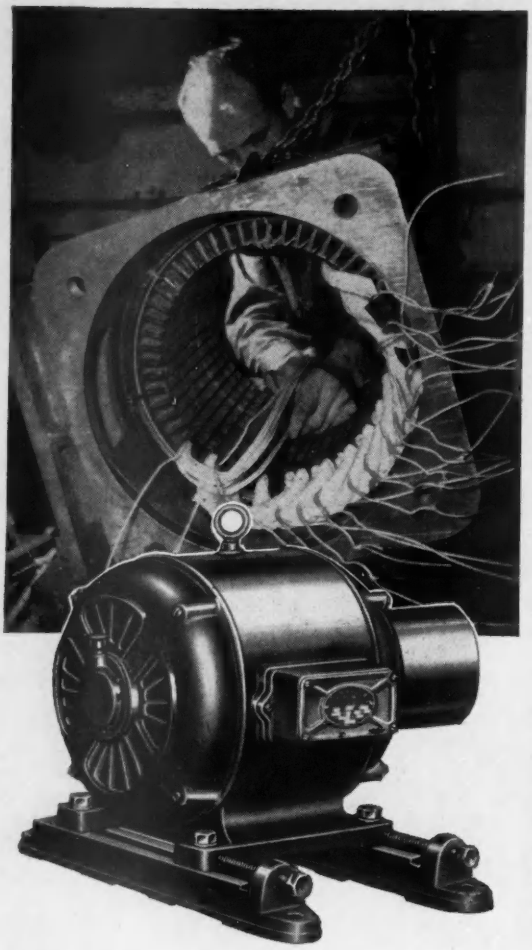

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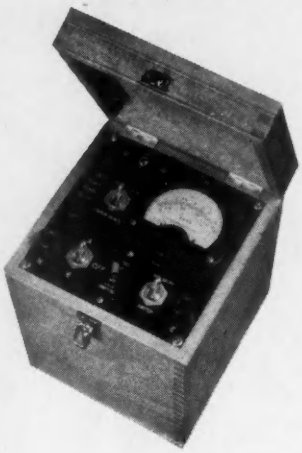

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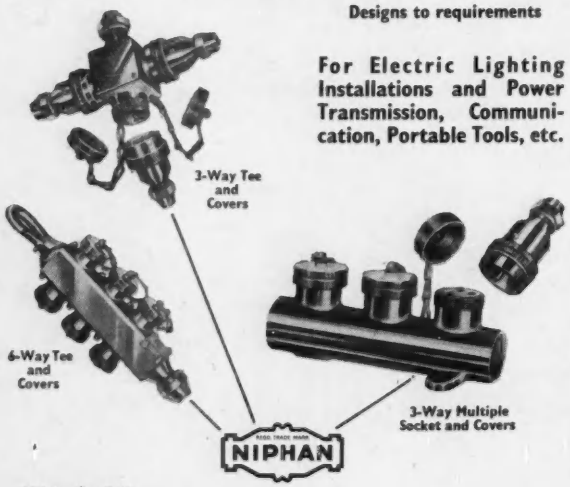

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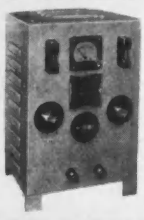

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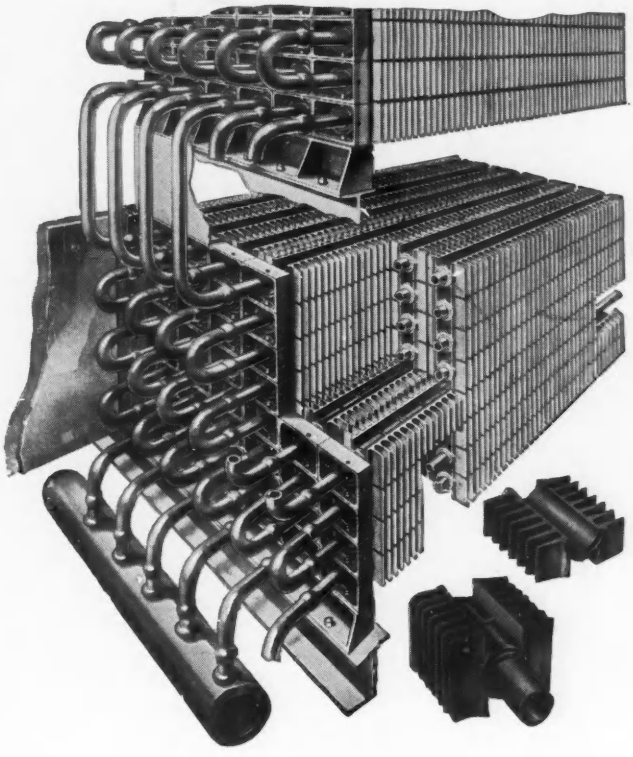

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